MODULAR FREEZER RACK

A rack for providing a lower cost solution for manufacturing and shipping is disclosed. The rack, suitable for use in freezer or cooling components comprises a top element, a bottom element and side elements between said top and bottom elements, linearly arranged, wherein three of said elements are joined together at corresponding edges with a flexible hinge mechanism, a joining mechanism including a catching mechanism and a connecting mechanism, said joining mechanism retaining adjacent ones of said elements in a substantially perpendicular arrangement, each of said elements including at least one of said catching mechanism and said connecting mechanism and adjacent ones of said elements contain alternate ones of said catching mechanism and said connecting mechanism; and a back element linearly attached with a flexible hinge mechanism along an edge of each of said side elements, wherein said back element includes a snap fit retaining mechanism along a top end and a bottom end of each edge.
FIG. 4
MODULAR FREEZER RACK

BACKGROUND OF THE INVENTION

[0001] Storage of biological samples often requires the use of a refrigerator and/or freezer unit. Such samples are commonly sealed in plastic micro-tubes (such as Cryovial brand from Simport Plastiques Ltee, Beloeil, Quebec, Canada), which are small vessels, each of which typically holds a total volume of 1 to 3 milliliters, and has a separate sealing screw cap. These tubes are commonly organized in standard 81-place (9x9 configuration) or 100-place (10x10 configuration) storage boxes or trays. The boxes and the tube holder frame can be made from cardboard (inexpensive, but not very durable), or plastic (such as polypropylene, or polycarbonate, typically with drain holes for liquid nitrogen storage). These boxes are available in different heights (typically 2 inches high or 3 inches high) to accommodate the most popular sized sample tubes. Another popular method stores samples in 96-well or 384-well microtiter plates with sealing lids, or small tubes that are configured into a 96-place pattern and have the same standard footprint dimensions of microtiter plates.

[0002] Microtiter storage boxes (i.e., trays) and storage microplates are typically organized in a laboratory refrigerator or freezer using a stainless steel rack having properly sized openings (shelf spaces) to hold the boxes (or plates). Current freezer racks are typically made of a stainless steel material having a number of shelves for holding specimen trays. The freezer racks are typically sized to accommodate known freezer compartment sizes such that one or more freezer racks may be placed within freezer compartment. The racks are sized such that a maximum amount of space within the freezer compartment is occupied, and a maximum number of storage boxes, trays or plates can be accommodated.

[0003] However, conventional freezer racks are bulky items as their construction requires that the racks be manufactured according to the desired size. This bulkiness further complicates the shipping of the racks as the shipping materials must accommodate the fully constructed freezer rack. In addition, the racks are constructed with the knowledge that the rack is suitable for a slide-in up-right freezer unit or a drop-in (chest style) freezer unit, and are constructed with shelf spaces for specific height boxes. Hence, there is currently a need for a lightweight and modular freezer rack that may be shipped in a disassembled, flat packaged form, assembled on-site and suitable for different sizes and types of freezer units, and can be used for various height boxes (such as common 2 inch and 3 inch high boxes).

SUMMARY OF THE INVENTION

[0004] A rack for providing a lower cost solution for manufacturing and shipping is disclosed. The rack, suitable for use in freezer or cooling components comprises a top element, a bottom element and side elements between said top and bottom elements, linearly arranged, wherein four of said elements are joined together at three shared edges with a flexible hinge mechanism, a joining mechanism including a catching mechanism and a connecting mechanism, said joining mechanism retaining adjacent ones of said elements in a substantially perpendicular arrangement, each of said elements including at least one of said catching mechanism and said connecting mechanism and adjacent ones of said elements contain alternate ones of said catching mechanism and said connecting mechanism; and a back element linearly attached with a flexible hinge mechanism along an edge of each of said side elements, wherein said back element includes a snap fit retaining mechanism along a top end and a bottom end of each edge.

BRIEF DESCRIPTION OF THE FIGURES

[0005] FIG. 1 illustrates a prospective view of an embodiment of the present invention in a first, unfolded, state;
[0006] FIG. 2 illustrates a prospective view of a locking mechanism of the present invention in a first state;
[0007] FIG. 3 illustrates a prospective view of a locking mechanism of the present invention in a second, folded, state;
[0008] FIG. 4 illustrates a prospective view of a locking mechanism of the present invention in a second, folded, state;
[0009] FIG. 5 illustrates a prospective view of an exemplary shelf unit in accordance with the principles of the invention;
[0010] FIGS. 6 and 7 illustrate prospective views of different configurations of an embodiment of the invention in accordance with the principles of the invention;
[0011] FIGS. 8A and 8B illustrate a first and second prospective view of a strap connector in accordance with the principles of the invention;
[0012] FIG. 9 illustrates an exemplary retaining ring in accordance with the principles of the invention;
[0013] FIGS. 10A and 10B illustrate prospective views of a plurality of racks in accordance with the principles of the invention; and
[0014] FIG. 11 illustrates an expanded view of the retaining ring shown in FIG. 10B in accordance with the principles of the invention.

[0015] It is to be understood that these drawings are solely for purposes of illustrating the concepts of the invention and are not intended as a definition of the limits of the invention. It will be appreciated that the same reference numerals, possibly supplemented with reference characters, where appropriate, have been used throughout to identify corresponding parts.

DETAILED DESCRIPTION OF THE INVENTION

[0016] FIG. 1 illustrates an exemplary freezer rack 100 in accordance with a first, unfolded, state, including top member 110, first side member 120, bottom member 130 and second side member 140, which are linearly joined together. First side member 120 and second side member 140 each includes a back surface 150.1, 150.2 linearly joined at back edge of the first and second side members. Back surface 150.1, 150.2, preferably, are limited is size to create a back surface that is not fully closed. However, it would be appreciated that back surface 150.1, 150.2 may be sized to provide a fully closed back surface when the freezer rack 100 is in a second, folded, state. In the embodiment shown in FIG. 1, the bottom element 130 is positioned between and adjacent to the side elements 120, 140. However, it would be recognized that it may be possible to provide an embodiment of the invention wherein a top member 110 may be positioned between and adjacent to side members 140 and 120 or a side member may be positioned between and adjacent to top member 110 and bottom member 130.

[0017] Each of top member (or element) 110, first side member 120, bottom member 130 and second side member 140 is a known material thickness. Between each member
110, 120, 130, and 140 the material thickness is substantially reduced so as to produce a region in which the member may be brought into substantially vertical orientation. Areas 145 are referred to in the art as a flexible hinge or “living hinge.” The use of a continuous, foldable, hinged material is advantageous as it allows for the flat shipment of the freezer rack in accordance with the principles of the invention. A hinge member 145 is also incorporated along a back edge of each of side members 120 and 140 to attach back surface 150.1, 150.2.

[0018] Along an edge adjacent to the living hinge of each of top member 110, first side member 120, bottom member 130 and second side member 140 is a plurality of locking or joining mechanisms 160 that lock respective ones of the members in substantially vertical orientation when the members are folded along the corresponding hinge. Also shown are catching mechanisms 172.1 on top member 110 and matching mechanism 172.2 on a top portion of back surface 150.1. Similar locking mechanisms 176.1 are shown on bottom member 130 and matching mechanism 176.2 on a bottom portion of back surface 150.1. Locking or catching mechanism 172.1, 172.2 and 176.1, 176.2 retain back surface 150.1 in substantially vertical orientation with top and bottom members 110, 130, respectively. Similar locking mechanisms 170.1, 170.2 and 174.1, 174.2 are shown on back surface 150.2. In one aspect of the invention, catching mechanism 172.2, 176.2, 170.2 and 174.2, may represent protrusions that engage corresponding catching mechanism 172.1, 176.1, 170.1, and 174.2, that are formed on back edges of top and bottom elements 110, 130 respectively. Catching mechanism 172.1, for example, may represent a pincer mechanism that engages corresponding protrusion 172.2 to create a snap-fit engagement or joining means. It would be recognized that catching mechanism 172.2 may represent a pincer mechanism and catching mechanism 172.1 may represent a protrusion that engages pincer mechanism 172.2.

[0019] Indentures or indents 190 are positioned along a front, first, edge of each of first side member 120 and second side member 140. Indentures 190 provide regions for joining together a plurality of freezer racks 100 when in a folded state, as will be explained with regard to FIGS. 11A and 11B. Along a back, second, edge of each of first side member 120 and second side member 140 are indentures 195. Indentures 195, in conjunction with indentures 190, provide regions for joining together a plurality of freezer racks 100 when in a folded, second, state. Also shown are raised areas 197 on each of back surfaces 150.1, 150.2, corresponding to each of indentures 195. In an alternate embodiment, a groove (not shown) may extend from indent 190 to indent 195.

[0020] FIG. 2 illustrates a prospective detailed view of locking or joining mechanism 160 when freezer rack 100 is in a first, unfolded, configuration. FIG. 2 illustrates a first latching element 160.1 extending substantially vertically from one of the members. In this illustrated example, latching or catching element 160.1 extends substantially vertically from a surface of first side element 120. Also shown is second latching or connecting element 160.2 comprising columns 210.1, 210.2 extending substantially vertically from surface 110, for example. Connection element 220 connects columns 210.1, 210.2 and forms a space 220.1 therebetwehen. Also incorporated into second latching or connection element 160.2 is leg 230 that extends substantially vertically from the surface of top member 110. A front surface 220.2 of connection element 220 is shown sloped away from latching element 160.1. The slope surface 220.2 is advantageous as it allows connection member 220 to slide over first latch element 160.1.

[0021] FIG. 3 illustrates a prospective detailed view of locking mechanism 160 when freezer rack 100 is in a second, folded, configuration. FIG. 2 illustrates in this folded configuration, first latching element 160.1 extending through the opening 220.1 (not shown) to so that first latch element 160.1 engages a rear surface 220.3 of connection member 220. Also illustrated is an end of leg 230 being in contact with surface 120. The purpose of the leg 230, and specifically its angled shape, is to guide sample boxes into the created shelf spaces so the sample boxes do not get stopped by the locking mechanism.

[0022] FIG. 4 illustrates a prospective view of freezer rack 100 in a second, folded, configuration. As illustrated, engagement mechanisms 160 retain each member in a substantially perpendicular orientation. Also engaging element 176 (i.e., 176.1, 176.2) and not shown elements 170 (170.1, 170.2), 172 (172.1, 172.2), and 174 (174.1, 174.2) retain back surface 150.1 (not shown 150.2) substantially vertical orientation to top and bottom members 110, 130, respectively. Also shown are protrusions 410 extending from an outer surface to an inner surface of first and second side members 120, 140. Protrusions 410 provide means for attaching shelves within the cavity formed by freezer rack 100 in this second configuration. Within raised areas 197 are openings 420. Openings 420 are substantially parallel to protrusions 420.

[0023] FIG. 5 illustrates a prospective view of a shelf 500 in accordance with principles of the invention. Shelves 500 is substantially flat are sized to fit within the freezer rack shown in FIG. 4. Protrusions 510, extending from the side edges of shelf 500 engage corresponding protrusions 410 in sides 120, 140 to lock shelf 500 in place with a snap fit connection. Also shown are pincers 520 along a back edge of shelf 500. Pincers 520 engage openings 420 to retain the back edge of shelf 500 in a fixed relationship.

[0024] FIG. 6 illustrates a first exemplary embodiment of the invention wherein two shelf elements 500 are positioned within the cavity formed by rack 100. In this configuration, rack 100 is capable of holding three (3) trays or boxes, which are typically sized at three inches in height. FIG. 7 illustrates a second exemplary embodiment of the invention wherein three shelf elements 500 are positioned within the cavity formed by rack 100. In this configuration, rack 100 is capable of holding four (4) boxes, sized at 2 inches in height.

[0025] Although the present invention has been illustrated with respect to a two shelf and a three shelf configuration, it would be recognized that more shelves may be incorporated into the freezer rack 100 by the proper placement of the protrusions 410.

[0026] FIG. 8 illustrates a prospective view of an exemplary strap connection for attaching freezer racks in accordance with the principles of the invention. In this exemplary embodiment, strap connection 800 is an extended length U-shaped device having a first end having a substantially U shape that connects two extended length arms 810.1, 810.2. At the end of each arm 810.1, 810.2 is a latching or capturing mechanism 820.1, 820.2, comprising a narrower arm 822.1, 822.2 extending from the arms 820.1, 820.2, respectively. Extending from arms 822.1, 822.2 are lip members 824.1, 824.2, respectively, that retain a nut or cap that may be placed on arms 822.1, 822.2. The flexibility of arms 810.1, 810.2 allow retaining rings sized to fit over lips 824.1, 824.2 to engage arms 822.1, 822.2.
FIG. 8B illustrates a second prospective view of strap connector 800 illustrating lips 820.1, 820.2, in further detail. Lips 824.1, 824.2 are shown in a preferable circular configuration, which may be used to retain a circular retaining ring. Although strap connector 800 is shown utilizing a snap fit connection, it would be recognized that the lips 824.1, 824.2 may be removed and threads incorporated onto arms 822.1, 822.2 and a threaded nut may be screwed onto arms 822.1, 822.2 to retain the ends of strap connector 800. FIG. 9 illustrates an exemplary retainer ring 900 in accordance with a preferred embodiment of the invention. Retainer ring 900 is sized to have an inner diameter dimension to fit over arms 822.1, 822.2 while to retaining arms 810.1, 810.2 in a substantially parallel arrangement. An outer diameter dimension of retainer ring 900 is sized to enable lips 824.1, 824.2 to engage flat surface 910. Alternatively, ring 900 may include a threaded section on the inner circumference to enable retaining ring 900 to be screwed onto a threaded end of arms 822.1, 822.2. FIG. 10A illustrates a prospective view of the construction of an exemplary modular freezer rack system 1000 incorporating racks 100A, 100B, and 100C in a frontal view. Although three racks are shown in this exemplary system, it would be recognized that a greater or a lesser number of racks 100 may be joined together dependent upon a desired size and or configuration. FIG. 10A illustrates joining racks 100A, 100B, 100C together with strap connectors 800 placed to engage first side member 120 of a first rack, e.g., 100B and a second side member 140 of an adjacent second rack, e.g., 100A. Strap connectors are placed along the first and second side member of adjacent racks (e.g., 100A, 100B) in corresponding ones of the indents or notch element 190. Indents 190 are sized so that the outer surface of “U” shaped section of strap 800 is flush with the outer edges of joined racks 100A, 100B, 100C. FIG. 10A further illustrates the placement of boxes 1010 on bottom member 130 and shelves 500. FIG. 10B illustrates a prospective view of the modular rack system 1000 shown in FIG. 10A with regard to a back view. In this illustrated embodiment of the invention, retainer rings 900 engage the arms of strap connector 800 that have been inserted into indentures 190 (not shown) and extended along first and second side member 120, 140, respectively of adjacent racks (e.g., 100A, 100B). Retaining rings 900 are positioned on arms 822.1, 822.2 (not shown) after being placed over lips 824.1, 824.2 (not shown). Retaining rings 900 are positioned within the raised arm 197 on back portion 150.1, 150.2 of adjacent racks (e.g., 100A, 100B). The use of raised areas 197 on back portion 150.1, 150.2, which create a recess in one side of back portion 150.1, 150.2, is advantageous as it provides a recessed area wherein rings 900 may be placed without extended past an outer edge of rack 100. FIG. 11 illustrates an expanded view of retainer ring 900 engage strap connector 800 within raised area 197. Strap connector, as noted previously, extends along side walls of adjacent racks 100A, 100B, for example, to a rear edge within raised area 197. Retaining ring 900 may then be placed over lips 824.1, 824.2, in a snap fit connection, to retain strap connector 800 in place. Also shown are openings 420 and pincers 520 along the back edge of shelf 500 engaging openings 420. Alternatively, an inner circumference of retaining ring 900 may include a screw thread that may be screwed onto a screw thread that may be incorporated onto arms 822.1, 822.2, in the absence of lips 824.1, 824.2. In another embodiment, a cotter pin attachment may be used to retain strap connector 800 in place. In this embodiment, arms 822.1, 822.2 may include a hole that allows for the insertion of a cotter pin. In another embodiment, a spring washer may be used to retain strap connector 800 in place. The spring washer may be placed over arms 822.1, 822.2 to retain the arms of strap connector 800 tightly against the sides of adjacent freezer racks. While there has been shown, described and pointed out fundamental novel features of the invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the invention. For example, it is expressly intended that all combinations of those elements and or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Moreover, it should be recognized that structures and or elements and or method steps shown and or described in connection with any disclosed form or embodiment of the invention may be incorporated in any other disclosed or described or suggested form or embodiment as a general matter of design choice. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

What is claimed is:

1. A rack comprising:
   a top element, a bottom element and side elements between a said top and bottom elements, linearly arranged, wherein four of said elements are joined together at three shared edges with a flexible hinge mechanism.
   a joining mechanism including a catching mechanism and a connecting mechanism, said joining mechanism retaining adjacent ones of said elements in a substantially perpendicular arrangement, each of said elements including at least one of said catching mechanism and said connecting mechanism and adjacent ones of said elements contain alternate ones of said catching mechanism and said connecting mechanism; and
   a back element linearly attached with a flexible hinge mechanism along an edge of each of said side elements, wherein said back element includes a snap fit retaining mechanism along a top end and a bottom end of each edge.
   a joining mechanism.

2. The rack according to claim 1, wherein said catching mechanism is positioned along edges of each of said top element and said bottom element.
3. The rack according to claim 1, further comprising:
   a retaining mechanism positioned along said top end and said bottom of each back edge of each of said top and bottom element, said retaining mechanism corresponding to said snap fit retaining mechanism on said back element.
4. The rack according to claim 1, wherein a first edge of each of said side elements includes at least one notch element.
5. The rack according to claim 4, wherein each of said back elements includes a raised area, said raised area corresponding to said notch element on said first edge.
6. The rack according to claim 1, wherein each of said side elements includes a plurality of protrusions extending from an outer surface of said side element to an inner surface of said side element.
7. The rack according to claim 1, wherein said joining mechanism further including:
   a leg element extending diagonally from a top of said connector mechanism, wherein a free end of said leg element contacts an adjacent element surface when said elements are positioned substantially perpendicular.

8. The rack according to claim 7, wherein said leg element is oriented toward a front edge of said side element.

9. The rack according to claim 6, wherein said raised area include a plurality of slots corresponding to said protrusions extending from an outer surface to an inner surface of said side element.

10. A rack comprising:
   a plurality of rack members joined together, wherein said joining mechanism comprises a strap connector extending from a front edge of adjacent ones of said plurality of rack members to a back edge of said adjacent ones of said plurality of rack members, said back edge including a recessed area for capturing an open end of said strap connector with a retaining mechanism.

11. The rack according to claim 10, wherein each of said racks comprises:
   a top element, a bottom element and side element between said top and bottom elements, linearly arranged, wherein three four of said elements are joined together at shared edges with a flexible hinge mechanism,
   a joining mechanism including a catching mechanism and a connecting mechanism, said joining mechanism retaining adjacent ones of said elements in a substantially perpendicular arrangement, each of said elements including at least one of said catching mechanism and said connecting mechanism and adjacent ones of said elements contain alternate ones of said catching mechanism and said connecting mechanism;
   a back element linearly attached with a flexible hinge mechanism along an edge of each of said side elements, wherein said back element includes a snap fit retaining mechanism along a top end and a bottom end of each edge, wherein
   a front edge of each of said racks including at least one notch element for capturing said strap connector.

12. The rack according to claim 10, wherein a first end of said strap connector includes a snap fit protrusion.

13. The rack according to claim 12, wherein said retaining mechanism is represents a locking ring engaging said snap fit protrusion.

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