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### RACK ASSEMBLY

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#### Abstract

A collapsible rack assembly includes a vertical support; a first elongated shelf having a first midpoint region, a rail extending therefrom, and a first end perpendicular to the rail; and a second elongated shelf including a second midpoint region having a notch apparatus. The vertical support is structured to extend between and support the first and second elongated shelves when the collapsible rack assembly is in an ASSEMBLED position. The notch apparatus is configured to receive the first end in order to allow the first elongated shelf to nest within the second elongated shelf when the collapsible rack assembly is in a COLLAPSED position.

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## Background/Summary

RELATED APPLICATION DATA [0001] This application is a Continuation-in-Part of and claims priority to U.S. Non-Provisional application Ser. No. 17/693,101, filed Mar. 11, 2022, which claims priority to U.S. Provisional Application Ser. No. 63/160,718, filed Mar. 12, 2021. The present application claims priority to said applications and incorporates by reference said applications as if set forth fully herein.

### FIELD OF THE INVENTION

[0002] The present invention relates to rack assemblies.

### BACKGROUND OF THE INVENTION

[0003] Rack assemblies are commonly used to shelve items. They are convenient because they can be disassembled and stored in somewhat ergonomic manners. Specifically, when disassembled and packaged, the rack assemblies take up relatively little space, as compared to shelving units that are of a generally fixed nature. However, although known rack assemblies are desirable for this reason, there are improvements that can be made. Specifically, when rack assemblies are shipped in bulk, every square inch of space matters. Today's rack assemblies, though collapsible, are deficient in this regard and thus leave manufacturers and those in supply chains at a disadvantage. Existing racks that can be assembled and disassembled are sometimes structurally weak and may wobble, tip or the like. The disclosed concept, as will be apparent, is an improvement in this and other regards.

### SUMMARY OF THE INVENTION

[0004] A collapsible rack assembly is provided. The assembly includes at least one vertical support and a plurality of elongated shelves each having a first side midpoint region and a second side midpoint region, each midpoint region disposed between a pair of first side corner regions. Each elongated shelf includes a midline rail extending between a first sleeve disposed at the first side midpoint region and a second sleeve disposed at the second midpoint region.

[0005] Each midline rail of the assembly has a top side rail and a bottom side rail, each rail having ends connected to the first sleeve and second sleeve of the respective elongated shelf. The bottom side of the midline rail includes a pair of first notches defined between the first sleeve and the second sleeve such that a notch of a first elongated shelf is configured to receive an end member of a second elongated shelf in order to allow the first elongated shelf to nest within the second elongated shelf when the collapsible rack assembly is in a COLLAPSED position.

[0006] In another aspect of the disclosed concept, a rack assembly is provided having a top side which is configured to be a level support surface. The assembly includes at least one vertical support and a plurality of elongated shelves each having a first side midpoint region disposed between a pair of corner regions with a pair of end rails which couple the midpoint region to the corner regions and extend downward from the top side. The assembly includes a midline rail extending downward from the top side and defining a pair of first notches. The at least one vertical support is structured to extend between and support the plurality of elongated shelves when the collapsible rack assembly is in an ASSEMBLED position. The pair of first notches of a first elongated shelf of the plurality of elongated shelves is configured to allow at least one of the end rails of another elongated shelf to nest within the first elongated shelf when longitudinally and laterally offset an inverted relative to one another, when the collapsible rack assembly is in a COLLAPSED position.

[0007] In another aspect of the disclosed concept, a rack assembly is provided having a plurality of elongated shelves. The elongated shelves may each comprise a first side rail, a second side rail, and a midline rail extending from a top side of each elongated shelf such that a pair of channels is formed on the bottom side of each elongated shelf. The rack assembly may have a first sleeve and a

second sleeve disposed on opposing ends of the midline rail. Each of the first side rail, the second side rail, and the midline rail may comprise a pair of notches.

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## Description

### DESCRIPTION OF THE DRAWINGS

[0008] These features and others will become more apparent when read in conjunction with the following Figures, in which:

[0009] FIG. 1 is a partially exploded front isometric view of a rack assembly, shown with features in phantom line drawing, in accordance with one non-limiting embodiment of the disclosed concept;

[0010] FIGS. 2-4 are top plan, side, and front views, respectively, of an elongated shelf for the rack assembly of FIG. 1;

[0011] FIG. 5 is an enlarged view of a portion of the front view of the elongated shelf of FIG. 4;

[0012] FIGS. 6-8 show different exploded views of portions of the rack assembly between ASSEMBLED and COLLAPSED positions;

[0013] FIGS. 9 and 10 show isometric and front views of elongated shelves for the rack assembly of FIG. 1 in a COLLAPSED position;

[0014] FIG. 11A is an isometric view of a rack assembly, shown in an ASSEMBLED position, in accordance with another non-limiting embodiment of the disclosed concept;

[0015] FIG. 11B is a front view of an elongated shelf for the rack assembly of FIG. 11A;

[0016] FIG. 12 is an isometric view of a rack assembly in an ASSEMBLED position, shown partially exploded, in accordance with another non-limiting embodiment of the disclosed concept;

[0017] FIG. 13 is an exploded isometric view of a portion of the rack assembly of FIG. 12;

[0018] FIGS. 14 and 15 are enlarged views of portions of the rack assembly of FIG. 13;

[0019] FIGS. 16 and 17 are enlarged views of portions of other rack assemblies, in accordance with other non-limiting embodiments of the disclosed concept;

[0020] FIGS. 18-21 show exploded and assembled views of different orientations of multiple rack assemblies and elongated shelves, in accordance with other non-limiting embodiments of the disclosed concept;

[0021] FIG. 22 is an isometric view of another elongated shelf for a rack assembly, in accordance with another non-limiting embodiment of the disclosed concept;

[0022] FIG. 23A shows an exploded isometric view of a portion of another rack assembly, in accordance with another non-limiting embodiment of the disclosed concept;

[0023] FIGS. 23B and 23C are different enlarged views of the portion of FIG. 23A;

[0024] FIG. 24 is an assembled isometric view of a portion of another rack assembly, in accordance with another non-limiting embodiment of the disclosed concept;

[0025] FIG. 25 is an isometric view of another elongated shelf, in accordance with yet a further embodiment of the disclosed concept;

[0026] FIG. 26 is an exploded view of another rack assembly, in accordance with another non-limiting embodiment of the disclosed concept;

[0027] FIGS. 27 and 28 are different views of portions of the rack assembly of FIG. 26, shown in a partially collapsed position;

[0028] FIG. 29 is an enlarged view of a portion of the rack assembly of FIG. 26;

[0029] FIGS. 30 and 31 are different top plan views of portions of the rack assembly of FIG. 26;

and

[0030] FIG. 32 shows the rack assembly of FIG. 26 in a COLLAPSED position;

[0031] FIG. 33 is an isometric view of a rack assembly, shown in an ASSEMBLED position, in accordance with another non-limiting embodiment of the disclosed concept;

[0032] FIG. **34** is an exploded isometric view of a portion of the rack assembly of FIG. **33**;  
[0033] FIG. **35** is a side view of a portion of the rack assembly of FIG. **33**;  
[0034] FIG. **36** is an enlarged view of a portion of the rack assembly of FIG. **35**;  
[0035] FIG. **37** is an exploded view of another rack assembly, in accordance with another non-limiting embodiment of the disclosed concept;  
[0036] FIG. **38** is a view of portions of the rack assembly of FIG. **37**, shown in COLLAPSED position;  
[0037] FIGS. **39**, **40A-40B** and **41** are top plan, side and cross-sectional, and front views, respectively, of an elongated shelf for the rack assembly of FIG. **38**;  
[0038] FIGS. **42A** and **42B** are enlarged views of a portion of the side and cross-sectional views of the elongated shelf of FIGS. **40A** and **40B**;  
[0039] FIG. **43** is an isometric view of a rack assembly, shown in an ASSEMBLED position, in accordance with another non-limiting embodiment of the disclosed concept;  
[0040] FIG. **44** is an exploded isometric view of a portion of the rack assembly of FIG. **43**; and  
[0041] FIG. **45** is a side view of the rack assembly of FIG. **43**.

#### DETAILED DESCRIPTION OF THE INVENTION

[0042] Reference to terms such as “left”, “right”, “top”, “bottom”, “front” and “back” are intended for use in respect to the orientation of the particular feature, structure, or element within the figures depicting embodiments of the invention. It would be evident that such directional terminology with respect to the actual use of a device has no specific meaning as the device can be employed in a multiplicity of orientations by the user or users.

[0043] The description of elements in each figure may refer to elements of proceeding figures. Like numbers refer to like elements in all figures, including alternate embodiments of like elements.

[0044] FIG. **1** shows a portion of a rack assembly **2**, that beneficially is collapsible into a compact package for shipping purposes. Rack assembly **2** is useful for storing items in a home, office, garage, warehouse, or other facility. In certain examples, a wire decking rack assembly such as is depicted is frequently referred to as “a baker's rack.” As shown, rack assembly **2** includes a plurality of vertical supports **4,5,6,7** (shown in phantom line drawing), a plurality of press fit members (two members **10,11** are indicated), and a plurality of elongated shelves or racks **20,40,60,80** (see FIGS. **6** and **7** for shelf **80**). Vertical supports **4,5,6,7**, in certain examples, are elongated tubular members (or rods, columns, etc.) that may be formed with a plurality of annular notches spaced evenly along a length of each vertical support **104**. Press fit members, e.g., wedge shaped plastic sleeves **10,11**, are configured to engage one of the annular notches and position and secure the elongated shelves **20,40,60,80** to vertical supports **4,5,6,7**. Additionally, in one example embodiment, vertical supports **4,5,6,7** and elongated shelves **20,40,60,80** are metallic.

[0045] Vertical supports **4,5,6,7** may each comprise a plurality of vertical members, or may be one unitary member made from a single piece of material (e.g., metal). They are structured to extend between and support elongated shelves **20,40,60,80** when rack assembly **2** is in an ASSEMBLED position. Moreover, for purposes that will be apparent below, each of elongated shelves **20,40,60,80** are preferably structured the same.

[0046] Referring to FIGS. **2-5**, elongated shelf **20** includes a corner region **22**, a sleeve member **23**, and a rail **24** extending from sleeve member **23** (or similar mount) of corner region **22**.

Additionally, it will be appreciated that press fit members **10,11** are configured to be coupled to one another, be disposed within sleeve member **23**, and receive vertical support **6** in order to secure vertical support **6** within sleeve member **23** in a press fit manner.

[0047] As shown in FIG. **4**, corner region **22** further has a notch apparatus in the form of a bent rail **26**. Bent rail **26** is advantageously structured to receive a rail of one of elongated shelves **40,60,80**, such as by forming or creating a notch or inset (such as where a rail or other portion of another shelf is located in the inset or notch created by the bent rail **26**, extending generally transverse or perpendicular thereto) in order to allow elongated shelf **20** to nest within the other elongated shelf

**40,60,80** when the collapsible rack assembly **2** is in a COLLAPSED position. This aspect of rack assembly **2** advantageously allows for improved space savings, as compared to known rack assemblies. In this manner, manufacturers will be able to ship more rack assemblies in transit and store owners will be able to stack more collapsed rack assemblies on shelves, to name a few of the advantages. This improvement in the flow of commerce translates into a cost savings for the parties involved.

[0048] Referring to FIG. 5, bent rail **26** preferably includes a first segment **30**, a second segment **31** parallel to the first segment **30**, and a third segment **32** connecting the first and second segments **30,31**. As shown, the third segment **32** extends at an angle **33** greater than ninety degrees from the first segment **30**. This construction allows for the aforementioned nesting capability, as will be appreciated below.

[0049] Additionally, as shown in FIG. 4, elongated shelf **20** further has another corner region **27** located opposite corner region **22** and having a notch apparatus in the form of a bent rail **28** which is symmetric to the bent rail **26** of corner region **22**. It will be appreciated that the other end of elongated shelf **20** has symmetric bent rails as well, which simplifies orienting rack assembly **2** in the COLLAPSED position.

[0050] As shown in FIGS. 6-10, elongated shelves **40,60** may be sandwiched between elongated shelves **20,80** when rack assembly **2** is in a COLLAPSED state. This is shown most clearly in FIG. 9, although since all elongated shelves **20,40,60,80** are preferably structured the same, it will be appreciated that the numbering of shelves are interchangeable. As shown in FIG. 9, rail **44** of elongated shelf **40** is nested within notch apparatus (e.g., bent rail **26**) of elongated shelf **20**. This translates into a significant space savings. More specifically, and referring to FIG. 10, elongated shelves **40,60** are structured to nest within elongated shelves **20,80** in the COLLAPSED position such that a combined height  $H1$  of elongated shelves **20,40,60,80**, when nested, is less than a combined height  $4*H2$  of elongated shelves **20,40,60,80**, individually, where  $H2$  is the height of each of elongated shelves **20,40,60,80** individually.

[0051] FIG. 11A shows another collapsible rack assembly **102**, in accordance with another non-limiting embodiment of the disclosed concept, wherein like numbers represent like features. FIG. 11B shows a front view of elongated shelf **120**. It will be appreciated with reference to FIG. 11B that corner region **122** has a cutout and the notch apparatus is in the form of an insert **126** coupled to the rack, such as the wire frame that forms a cutout. Insert **126** may be made of a different material than the rest of elongated shelf **120**. As shown, insert **126** has a groove (or inset or notch) **130** for receiving a rail of elongated shelf **140** in a similar manner in which bent rail **26** (FIG. 9) of elongated shelf **20** (FIG. 9) received rail **44** (FIG. 9) of elongated shelf **40** (FIG. 9). Accordingly, stacking advantages discussed above with reference to rack assembly **2** also apply to rack assembly **102**.

[0052] FIG. 12 shows another rack assembly **202** in accordance with another embodiment of the disclosed concept, wherein like reference numbers represent like features. FIG. 13 shows an exploded view of a portion of the rack assembly **202** of FIG. 12. As shown, elongated shelf **220** has an end **222** with opposing corner regions **224,226** that each have a corresponding opening **225,227**. Additionally, rack assembly further has a pair of end caps **235,245** coupled to elongated shelf **220** (see also end caps **255,256,265,266,275,276,285,286** in FIG. 12 for elongated shelves **250,260,270,280**). In one example embodiment, elongated shelves **220,250,260,270,280**, vertical supports **204,205,206,207**, and end caps **235,245,255,256,265,266,275,276,285,286** are all metallic.

[0053] Each of elongated shelves **220,250,260,270,280** is configured to couple with end caps **235,245,255,256,265,266,275,276,285,286** in order to reduce an overall footprint. In particular, the removable end caps allow for the vertical supports to be stacked on the elongated shelves when packaged, and reduce the overall height of the packaging, and allowing for more packaged rack assemblies **202** to be shipped in a shipping container.

[0054] As shown in FIG. 12, end cap 235 has first and second thru holes 236,237 that are each aligned with a corresponding opening 225,227 of elongated shelf 220 and configured to receive vertical supports 206,207. It will be appreciated that end cap 245 likewise receives vertical supports 204,205 in a similar manner. Also shown in FIG. 12, end cap 235 has a thru hole 238 (and another thru hole disposed proximate thru hole 236) located proximate thru hole 237. Rack assembly 202 further has a pair of fasteners (e.g., without limitation, one set screw 244 is indicated) configured to extend through a corresponding one of the thru holes 238 (and the other opposing thru hole, not shown) of end cap 235 and be located proximate the vertical supports 206,207 in order to more securely maintain rack assembly 202 in an ASSEMBLED position.

[0055] Referring to FIGS. 14 and 15, rack assembly 202 further includes a number of inserts 240,246 each coupled to the vertical supports 206,207. In one example embodiment, the inserts 240,246 are each coupled to an interior of the vertical supports 206,207. Insert 240 may be a cap that is located at a top of the rack assembly 202 when rack assembly 202 is in an ASSEMBLED position and disposed on a horizontal ground. See, for example, FIG. 12. Three other inserts are also shown in this FIG., but only insert 240 is indicated. Insert 240, and the other three inserts, may function to provide surfaces for a table to advantageously be formed on rack assembly 202. Additionally, as shown in FIG. 14, insert 240 has a number of ridges 241-1,241-2,241-3 that may be configured to be located in corresponding grooves of vertical support 206 in order to maintain insert 240 in a fixed position within vertical support 206. As insert 240 functions to provide a top of rack assembly 202, insert 246 shown in FIG. 15 functions to provide a foot for rack assembly 202, so that it can more stably be positioned in an upright manner when in an ASSEMBLED position and located on a horizontal ground. As shown in FIG. 12A, three other feet (not labeled) are also provided with rack assembly 202. Continuing to refer to FIG. 15, an externally threaded sleeve 247 may be provided in order to more securely couple insert 246 to vertical support 207.

[0056] An insert 342,442 may also be threadably coupled to an interior of a vertical support 306,406-1,406-2, as shown in FIGS. 16 and 17. In the case of the embodiment of FIG. 16, insert 342, which functions as a top, is relatively securely coupled by virtue of the threads. Regarding the embodiment of the rack assembly of FIG. 17, insert 442 advantageously allows for segment 406-1 of the vertical support to be more stably connected to segment 406-2, where before they might only have been maintained at such a joint via a press fit connection.

[0057] FIGS. 18 and 19 show assembled and exploded views, respectively, of rack assemblies 502 and an elongated shelf 520 configured to be coupled in order for more versatile applications to be provided, such as further storage capabilities. FIGS. 20 and 21 show assembled and exploded views, respectively, of rack assemblies 502 and an elongated shelf 520 configured to be coupled in order for more versatile applications to be provided, such as further storage capabilities. In some configurations, connectors, such as fasteners, may be used to join the shelves 520 and/or racks 502. For example, one or more apertures may be provided in the end caps 245 (see FIG. 13), whereby aligned end caps (such as placed side by side or end to end) may be joined, such as with one or more fasteners (such as a nut/bolt, etc.)

[0058] FIG. 22 shows an isometric view of another elongated shelf 620. As shown, the elongated shelf 620 includes a first half portion 621, a second half portion 623, and an elongated sleeve 625 for connecting the first and second half portions 621,623. Accordingly, it will be appreciated that yet an even greater space savings can be afforded for rack assemblies including elongated shelves structured the same as elongated shelf 620, in that different portions 621,623 can be overlaid on top of one another in order to further reduce the footprint of a corresponding rack assembly.

[0059] FIG. 23A shows a portion of another rack assembly 702, wherein like reference numbers represent like features. As shown, end cap 735 has an aperture 738 disposed proximate thru hole 737, and a further aperture disposed on an opposing side (not shown). Referring to FIGS. 23B and 23C, elongated shelf 720 has a number of plates 740,741,742 coupled to corner region 726. Plate 742 has a push pin 743 extending outwardly therefrom and being biased away from elongated shelf

**720**. Push pin **743** is configured to extend through thru holes of plates **740,741**, which are securely maintained on corner region **726** by engaging and being disposed between opposing wires of corner region **726**. Furthermore, it will be appreciated that push pin **743** is configured to extend through aperture **738** of end cap **735** in order to securely maintain and connect end cap **735** with elongated shelf **720**. Opposing corner region **724** (FIG. 23A) and end cap **745** (FIG. 23A) are similarly structured and coupled in this pin to aperture manner, and so are other end caps and elongated shelves of rack assembly **702** (not shown). Accordingly, if end cap **735** is caused to slide with respect to elongated shelf **720**, the engagement between push pin **743** and plates **740,741** advantageously prevents decoupling.

[0060] FIG. 24 shows yet a further embodiment of the disclosed concept, wherein a portion of a rack assembly **802** is shown. As shown, rack assembly **802** has an elongated shelf **820** which is devoid of notches proximate end portions that couple to end caps—such as by not including an end rail at all, but wherein the end cap forms the end portion of the rack.

[0061] In one configuration, as illustrated in FIG. 25, the elongated shelf **920** may define having cutout portions proximate corner regions **922,924,926,928**, which regions accept the end caps, including the associated sleeves. The resulting reduced thickness, as discussed above, advantageously allows elongated shelf **920** to be shipped with a reduced footprint, and may allow end caps to either be fixedly attached thereto, or otherwise be connected thereto during shipping and shelving.

[0062] One aspect of this version of the invention is that elongated shelf **820** and other elongated shelves of rack assembly **802** can be stacked with a minimal footprint. Additionally, because of the reduced thickness proximate end portions of elongated shelf **820**, end caps may be able to be fixedly attached to end portions, or otherwise connected while elongated shelf **820** is being shipped, thereby saving assembly time downstream. For example, in one packing configuration, the end caps are removed from a first rack, allowing it to be placed between second and third racks having the end caps attached thereto (wherein the reduced thickness of the first rack allows it to be placed between the second and third racks without an increase in stack dimension due to the space between the second and third racks created because of the increased dimension of the end cap/sleeves of the second and third racks).

[0063] In particular, FIG. 26 shows an exploded view of another rack assembly **1002**, which includes vertical supports **1004-1,1005-1,1006-1,1007-1,1004-2,1005-2,1006-2,1007-2**, elongated shelves **1020,1040,1060,1080,1090**, and end caps **1025,1026,1085, 1086,1095, 1096**. FIGS. 27 and 28 show different partially exploded views of the rack assembly **1002**. As will be appreciated below, rack assembly **1002** is configured to collapse in a relatively ergonomic manner. FIGS. 29-31 show different views of portions of the rack assembly of FIG. 26, and FIG. 32 shows an isometric view of rack assembly **1002** in a COLLAPSED position. As shown, the vertical supports (shown but not labeled) are enclosed by the elongated shelves **1020, 1080,1090** without any being sacrificed, as can be appreciated by viewing the end caps. As shown, with two end caps **1085,1095** removed and coupled externally, all of the elongated shelves (e.g., including shelves **1040,1060** from FIG. 26, which fit between shelves **1020,1080**) can fit in the collapsed assembly. Additionally, as shown in FIGS. 29-31, the collars of end caps **1086** have notches in order to allow the shelves that have the removed end caps (e.g., end caps **1085,1095**, see FIG. 32) to be slid into the notch a predetermined distance, so that the side rails fit into the slot in the collar of the end cap of the shelf above it. It will be appreciated that the two collars of end cap **1086** and the two collars of end cap **1096** have such notches, as shown in FIG. 32. In one embodiment, utilizing this notched collar configuration, the shelves that have the removed end caps need to only be slid over or offset by 0.25" to align the side rails into the notches, thus facilitating nearly aligned stacking of the shelves, but at the same time allowing the shelves without the end caps to be located in between the pairs of shelves with the end caps (this 0.25 inch offset is much smaller than other stacking configurations, such as the configuration where a notch is located in the wire of the decking or in an insert adjacent

to the collar, in versions described above, and is much less in stacking height as compared to existing prior art where the shelves are directly placed on top of one another).

[0064] As illustrated in FIG. 1, in one configuration the sleeves **23** may extend upwardly above and downwardly below a top and/or bottom of the shelf. However, in other embodiments, the top and/or bottom of the sleeve (such as integrated into the end cap) might be generally flush with the top (and/or bottom) thereof, such as illustrated in FIGS. **24-25**, and also in FIG. **13** (and whereby the cap or insert **240** (see FIG. **14**) may merely be used to close the opening in the end cap or sleeve, with the top of the cap being generally flush with the top of the end cap.

[0065] FIG. **24** also illustrates how the rail portions of the shelf, such as the side rails (but also the end rails, as in the configuration illustrated in FIG. **1**) may be solid rails, rather than formed from wires (such as parallel wires with an intermedia Z-wire).

[0066] As indicated above, the end caps may be generally permanently mounted to one or more of the shelves, but in other embodiments, they may be removably attached, such as to for shipping and storage. In such a configuration the end caps might be connected to the shelf by one or more fasteners (nuts/bolts, push-pins, etc.)

[0067] FIGS. **33** and **34** show another collapsible rack assembly **1102**, in accordance with another non-limiting embodiment of the disclosed concept, wherein like numbers represent like features. Collapsible rack assembly **1102** may comprise similar features as previously disclosed rack assemblies, such as end caps, inserts, sleeves, elongated sleeves, solid rails, cutouts, etc. It should be appreciated that, for brevity, such features may not be repeated or may not be repeated below in as much detail, but these features are also compatible with the rack assembly **1102**. Collapsible rack assembly **1102** comprises a plurality of vertical supports **1104,1106**, a plurality of press fit members **1110,1111**, and a plurality of elongated shelves or racks **1120,1140,1160,1180**. Vertical supports **1104,1106**, in certain examples, are like vertical supports **4,5,6,7**. Press fit members **1110,1111**, in certain examples, are like press fit members **10,11**. Elongated shelves **1120,1140,1160,1180** are like elongated shelves **20,40,60,80**.

[0068] With reference to FIGS. **39-42B**, elongated shelf **1120** may have rail and notch features similar to those of elongated shelf **20**. However, elongated shelf **1120** comprises sleeve members **1123** located at a midpoint region **1121** of rack **120** rather than a corner region **1122**. Elongated shelf **1120** may comprise a midpoint region **1121**, a sleeve member **1123** disposed at the midpoint region **1121**, and a midline rail **1124** extending from sleeve member **1123**. Midline rail **1124** may extend from a top side of elongated shelf **1120**. Additionally, it will be appreciated that press fit members **1110,1111** are configured to be coupled to one another, be disposed within sleeve member **1123**, and receive vertical support **1106** in order to secure vertical support **1106** within sleeve member **1123** in a press fit manner. Elongated shelf **1120** may comprise corner regions **1122** formed by perpendicular rails **1125,1135**. Rails **1125,1135** may be coupled to each other to form corner regions **1122**.

[0069] While generally referred to as side rails **1125** (or rails **1125**), rails **1125** may comprise side rails **1125a, 1125b** (see FIG. **39**). Rail **1125a** may extend along a first side of elongated shelf **1120**. Rail **1125b** may extend along a second side of elongated shelf **1120**.

[0070] While generally referred to as end rails **1135** (or rails **1135**, end members **1135**), rails **1135** may comprise end rails **1135a,1135b**. End rail **1135a** may extend from sleeve **1123** toward a first side of elongated shelf **1120**. End rail **1135b** may extend from sleeve **1123** toward a second side of elongated shelf **1120**. Rails **1135** and sleeves **1123** may define a first end or a second end of elongated shelf **1120**.

[0071] Each of rails **1124,1125,1135** may extend from a top side of elongated shelf **1120**. The top side of elongated shelf **1120** may comprise a wire decking forming a level support surface. For example, and with brief reference to FIG. **43**, elongated shelves **1120,1220** may form level support surfaces for tools, bins, etc. In this manner, rails **1124, 1125,1135** may form the perimeter of gaps, or channels, defining a bottom side of elongated shelf **1120**.



[0072] A cross-section of elongated shelf **1120** is shown in FIG. **40B**. More specifically, a side view of midline rail **1121** is illustrated. Midline rail **1121** may have a top side rail **1161** and a bottom side rail **1162**. Midline rail **1121** may have a notch apparatus in bottom side rail **1162** in the form of a bent rail **1126**. Bent rail **1126** is advantageously structured to receive a rail of one of elongated shelves **1140,1160,1180**, such as by forming or creating a notch or inset (such as where a rail or other portion of another shelf is located in the inset or notch created by the bent rail **1126**, extending generally transverse or perpendicular thereto) in order to allow elongated shelf **1120** to nest within the other elongated shelf **1140,1160,1180** when the collapsible rack assembly **1102** is in a COLLAPSED position.

[0073] Referring to FIG. **42B**, bent rail **1126** preferably includes a first segment **1130**, a second segment **1131** parallel to the first segment **1130**, and a third segment **1132** connecting the first and second segments **1130,1131**. As shown, the third segment **1132** extends at an angle **1133** greater than ninety degrees from the first segment **1130**. This construction allows for the aforementioned nesting capability, as will be appreciated below.

[0074] Additionally, as shown in FIG. **40B**, elongated shelf **1120** further has another midpoint region **1141** located opposite midpoint region **1121** and having a notch apparatus in the form of a bent rail **1146** which is symmetric to the bent rail **1126** of midpoint region **1121**. It will be appreciated that the other end of elongated shelf **1120** has symmetric bent rails as well, which simplifies orienting rack assembly **1102** in the COLLAPSED position.

[0075] A side view of the length of elongated shelf **1120** is shown in FIG. **40A**. More specifically, a side view of side rail **1125** is illustrated. Side rail **1125** may have a top side rail **1163** and a bottom side rail **1164**. Side rail **1125** may have a second notch apparatus in bottom side rails **1164** in the form of a bent rail **1136**. Bent rail **1136** is advantageously structured to receive a rail of one of elongated shelves **1140,1160,1180**, such as by forming or creating a notch or inset (such as where a rail or other portion of another shelf is located in the inset or notch created by the bent rail **1136**, extending generally transverse or perpendicular thereto) in order to allow elongated shelf **1120** to nest within the other elongated shelf **1140,1160,1180** when the collapsible rack assembly **1102** is in a COLLAPSED position.

[0076] Referring to FIG. **43A**, bent rail **1136** preferably includes a first segment **1150**, a second segment **1151** parallel to the first segment **1150**, and a third segment **1152** connecting the first and second segments **1150,1151**. As shown, the third segment **1152** extends at an angle **1153** greater than ninety degrees from the first segment **1150**. Bent rail **1136** preferably includes a fourth segment **1156** and a fifth segment **1154** connecting the second and fourth segments **1151,1156**. As shown, the fifth segment **1154** extends at an angle **1155** greater than ninety degrees from the fourth segment **1156**. This construction allows for the aforementioned nesting capability, as will be appreciated below.

[0077] Additionally, as shown in FIGS. **39** and **40A**, elongated shelf **1120** further has another corner region **1142** located opposite corner region **1122** and having a notch apparatus in the form of a bent rail **1148** which is symmetric to the bent rail **1136** of corner region **1122**. It will be appreciated that the other end of elongated shelf **1120** has symmetric bent rails as well, which simplifies orienting rack assembly **1102** in the COLLAPSED position.

[0078] In the embodiment described, the bent rails **1136,1126** and **1136** at one end of the rack **1102** are aligned transversely (from the front to the back of the shelf) and the bent rails **1148, 1146,1148** at the other end of the rack **1102** are also aligned transversely, allowing those sets of aligned bent rails to accept an elongate (and linear) element in the notches formed thereby, and particularly, rail portions of another shelf.

[0079] FIG. **34** shows an exploded isometric view of a portion of the collapsible rack assembly **1102**, wherein like reference numbers represent like features. As shown, elongated shelf **1180** has an end **1222** with opposing corner regions **1224, 1226** and a midpoint region **1221**. Midpoint region **1221** has an opening **1225**. Collapsible rack assembly **1102** may have end caps (not shown) similar

to end caps 235,245,255,256,265,266,275,276,285,286.

[0080] While in some embodiments the bottom end of the vertical supports **1104,1106** might simply press-fit into the sleeves **1123** of the bottom shelf **1180**, in other embodiments, they may be fastened thereto, such as to prevent them from disconnecting from the sleeves **1123** due offset loading or the like. In one embodiment, collapsible rack assembly **1102** may have a number of inserts **1240,1246** each coupled to the vertical supports **1104,1106**. In one example embodiment, the inserts **1240,1246** are each coupled to an interior of the vertical supports **1104,1106**, such as where the inserts **1240,1246** each have a threaded stud which extends upwardly to engage a threaded aperture in an insert or other portion of the vertical support **1104,1106**. In one embodiment, the user might rotate the inserts **1240,1246** to couple them with the vertical supports **1104,1106**, and in others, might turn an exposed head of the fastener (such as located at the bottom of the insert) to so connect them. In other embodiments, the inserts **1240,1246** might be connected to the vertical supports **1104,1106** in other fashions. For example, the exterior of the body of the inserts might be threaded for engagement with threads on the interior of the vertical supports **1104,1106** (or vice versa). In yet other embodiments, the vertical support **1104,1106** might be directly connected to the sleeves **1123** (such as by a fastener which extends through wall of the sleeve **1123** into engagement with the vertical support), via threading engagement directly to the sleeve, etc. Inserts **1240,1246** may be caps located at a top or a bottom of the rack assembly **1102** when rack assembly **1102** is in an ASSEMBLED position and disposed on a horizontal ground. See for example, FIG. 33.

[0081] Inserts **1240,1246** may be disposed at a top of (see FIG. 35) rack assembly **1102** and may function to provide surfaces for a table to advantageously be formed on rack assembly **1102**. Inserts **1240,1246** may couple to rack assembly **1102** in similar manners as inserts **240,342,442**. For example, inserts **1240,1246** may be press fit inserts, notched inserts, threaded inserts, etc. As shown in FIGS. 34 and 35, inserts **1240,1246** function to provide a foot for rack assembly **1102**, so that it can more stably be positioned in an upright manner when in an ASSEMBLED position and located on a horizontal ground. As shown in FIGS. 34 and 35, rack assembly may have corner support feet **1251,1252,1253,1254** disposed at each corner. While depicted for illustrative purposes in FIGS. 33 and 34 as casters, it should be appreciated that the corner support feet **1251,1252,1253,1254** may alternatively be fixed feet, as described in more detail below with respect to FIGS. 43 and 44. In one embodiment, sleeve-style inserts may be located at each corner, each of which may define an aperture for receiving a stem element of a corresponding foot. These inserts might be welded to the rack assembly **1202** (such as the bottom shelf **1180**), such as at the corners thereof. Of course, the feet might be connected to the rack assembly **1202** in other manners (threading engagement, one or more fasteners, etc.)

[0082] FIG. 35 illustrates a cross-sectional side view of a portion of the rack assembly **1102**. Elongated shelves **1120,1140,1160,1180** may be placed at various intervals along the height of rack assembly **1102**. Elongated shelves **1120,1140,1160,1180** may be coupled to vertical supports **1104,1106** similarly to how elongated shelves **20,40,60,80** are secured to vertical supports **4,5,6,7**. While illustrated as having four elongated shelves evenly spaced, it is understood that rack assembly **1102** may comprise any number of elongated shelves disposed at various and adjustable locations along vertical supports **1104,1106**.

[0083] FIG. 36 is an enlarged view of a portion of the rack assembly **1102**. Elongated shelf **1120** is secured at a first height along vertical support **1106**. Press fit members **1110** and **1111**, similar to press fit members **10,11** are configured to be coupled to one another, be disposed within sleeve member **1123**, and receive vertical support **1106** in order to secure vertical support **1106** within sleeve member **1123** in a press fit manner.

[0084] As shown in FIGS. 37 and 38, elongated shelves **1140,1160** may be sandwiched between elongated shelves **1120,1180** when rack assembly **1102** is in a COLLAPSED state in a similar manner to elongated shelves **20,40,60,80** as illustrated in FIGS. 6-10. This is shown most clearly in

FIG. 38, although since all elongated shelves **1120,1140,1160,1180** are preferably structured the same, it will be appreciated that the numbering of shelves are interchangeable. As shown in FIG. 38, rail **1144** of elongated shelf **1040** is nested within notch apparatuses (e.g., bent rails **1126, 1136**) of elongated shelf **1120**, by longitudinally and transversely offsetting, and inverting, alternating shelves. This translates into a significant space savings. More specifically, elongated shelves **1140,1160** are structured to nest within elongated shelves **1120,1180** in the COLLAPSED position such that a combined height  $H3$  of elongated shelves **1120,1140,1160,1180**, when nested, is less than a combined height  $4*H4$  of elongated shelves **1120,1140,1160,1180**, individually, where  $H4$  is the height of each of elongated shelves **1120,1140,1160,1180** individually.

[0085] As also illustrated in FIG. 38, the vertical supports **1104,1106** may comprise multiple connectable portions, where the lengths of those portions do not exceed the greatest dimension of the shelves **1120,1140, 1160,1180**, allowing them to be packaged with the shelves (such as in the space between two or more of the shelves) without increasing the dimensions (height, width or length) of the disassembled rack beyond the dimensions of the stacked shelves.

[0086] FIG. 43 illustrates an isometric view of a rack assembly **1302**, shown in an ASSEMBLED position, in accordance with another non-limiting embodiment of the disclosed concept, wherein like numbers represent like features. FIG. 44 illustrates an exploded isometric view of a portion of the rack assembly **1302**. FIG. 45 illustrates a side view of the rack assembly of **1302**.

[0087] As depicted in FIGS. 43-45, collapsible rack assembly **1302** may comprise similar features as previously disclosed rack assemblies, such as end caps, inserts, sleeves, elongated sleeves, solid rails, cutouts, etc. It should be appreciated that, for brevity, such features may not be repeated or may not be repeated below in as much detail, but these features are also compatible with the rack assembly **1302**.

[0088] Rack assembly **1302** may be a compact version of rack assembly **1102**. Rack assembly **1302** may have a more compact wire decking arrangement as compared to rack assembly **1302**. Rack assembly **1302** may comprise three elongated shelves **1320,1340,1360** rather than four.

[0089] FIGS. 42-45 illustrate alternative corner support feet **1451,1452,1453,1454**. Corner support feet **1451,1452,1453,1454** are fixed feet. Corner support feet **1451,1452,1453,1454** may be individually adjustable so as to assist in creating level shelves on slightly uneven or sloped ground. Corner support feet **1451,1452,1453,1454** may be threaded, have slots, or other adjustment mechanisms to iteratively or smoothly adjust a height of each foot. It should be appreciated that corner support feet **1251,1252,1253,1254** are interchangeable between rack assemblies **1102** and **1302**. Similarly, corner support feet **1451,1452,1453,1454** are interchangeable between rack assemblies **1102** and **1202**.

[0090] Rack assembly **1302** may comprise inserts **1440,1446** similar to inserts **1240,1246**. For illustrative purposes, inserts **1440,1446** are depicted as similar to insert **240** of FIG. 14. However, it should be understood that any insert disclosed herein is compatible with rack assembly **1302**.

[0091] As illustrated in FIGS. 43-45, adjustable rack assembly **1202** may comprise at least one wall mount **1410** for securing at least one elongated shelf **1320,1340,1360** to a wall. It should be appreciated that wall mount **1410** is compatible with any of the previously described rack assemblies in addition to rack assembly **1202**.

[0092] One advantage to the racks **1102,1302** just described is that the shelves may be supported by just two vertical supports, such as vertical supports **1104,1106** which are located at opposing ends of the rack and at the midpoint region of the shelves. The reduced number of vertical supports reduces the material cost for the rack, reduced the costs of shipping and storage due to the reduced weight and space occupied thereby, and reduces the complexity of assembly to a user. In one embodiment, the midline rail **1124** serves as a load beam for mass which is supported by the associated shelf, transmitting that load to the vertical supports **1104,1106** at each end thereof.

[0093] In the embodiment which is illustrated, notches are defined by bent rail sections **1136,1148** at the sides of the shelves. However, as indicated above relative to the embodiment illustrated in

FIG. 1, the bent rail sections and notches could be located at the ends of the shelves. An advantage of locating the bent rails sections **1136,1148** at the sides of the shelves in this embodiment (where sleeves are not located at the corners as in the rack illustrated in FIG. 1) is that it allows the top and bottom side rails **1163,1164** to be joined (such as by a weld) at additional locations along the sides (near the corners in this example), which greatly increases the strength of the trussed front and rear sides of the shelves (in the embodiment illustrated in FIG. 1, this issue is addressed by having the top and bottom rails join to the corner-located sleeves). However, it is possible (such as for lighter load racks) for the rack assembly **1202** to utilize bend end rail sections which define notches (along with notches in the center or midline rail **1124**) which again allows the shelves to be stack in a reduced height-dimension configuration similar to the rack assembly illustrated in FIG. 1.

[0094] This description uses examples to describe embodiments of the disclosure and also to enable any person skilled in the art to practice the embodiments, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the disclosure is defined by the claims and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims. For example, it will be appreciated that suitable alternative embodiments of the disclosed concept include elongated shelves have different aspects from any of the different aforementioned embodiments.

## Claims

1. A collapsible rack assembly comprising: a plurality of elongated shelves, each elongated shelf having a first side, a second side, a first end, a second end, a top side, and a bottom side and comprising: a first side midpoint region disposed between a pair of first side corner regions, a second side midpoint region disposed between a pair of second side corner regions, a first sleeve disposed at the first side midpoint region, a second sleeve disposed at the second side midpoint region, a midline rail extending from the first sleeve to the second sleeve; and at least one vertical support structured to extend between and support the plurality of elongated shelves when the collapsible rack assembly is in an assembled position.
2. The collapsible rack assembly according to claim 1, wherein each midline rail has a top side rail and a bottom side rail, each having ends connected to the first sleeve and the second sleeve.
3. The collapsible rack assembly according to claim 2, wherein the bottom side rail of the midline rail includes a pair of first notches defined between the first sleeve and the second sleeve.
4. The collapsible rack assembly according to claim 3, wherein each first notch is formed by a first segment coupled at a first obtuse angle with a second segment, the second segment coupled at a second obtuse angle with a third segment, the third segment coupled to one of the first sleeve or the second sleeve.
5. The collapsible rack assembly according to claim 3, wherein each of the plurality of elongated shelves further comprises a plurality of end members extending from at least one of the first sleeve or the second sleeve in opposing directions and perpendicular to the midline member.
6. The collapsible rack assembly according to claim 5, wherein at least one of the first notches of a first elongated shelf of the plurality of elongated shelves is configured to allow at least one of the plurality of end members of another elongated shelf to nest within the first elongated shelf when the collapsible rack assembly is in a collapsed position.
7. The collapsible rack assembly according to claim 5, wherein each corner region has a second notch, the second notches being aligned with a corresponding first notch.
8. The collapsible rack assembly according to claim 6, wherein each second notch is formed by a third segment coupled at a third obtuse angle with a fourth segment, the fourth segment coupled at a fourth obtuse angle with a fifth segment, the fifth segment coupled at a fifth obtuse angle with a

sixth segment, the sixth segment coupled to one end member at least one of the pair of first end members or the pair second end members.

**9.** The collapsible rack assembly according to claim 5, further comprising a third elongated shelf of the plurality of elongated shelves, the third elongated shelf comprising a plurality of adjustable feet disposed in the corner regions.

**10.** A collapsible rack assembly comprising: a plurality of elongated shelves, each elongated shelf having a first side, a second side, a first end, a second end, a top side configured to be a level support surface, and a bottom side and comprising: a first side midpoint region disposed between a pair of first side corner regions, a pair of first end rails coupling the first side midpoint region to the first side corner regions and extending downward from the top side, and a midline rail extending downward from the top side, extending from the first side midpoint region, and defining a pair of first notches; at least one vertical support structured to extend between and support the plurality of elongated shelves when the collapsible rack assembly is in an assembled position, wherein the pair of first notches of a first elongated shelf of the plurality of elongated shelves is configured to allow at least one of the first end rails of another elongated shelf to nest within the first elongated shelf when the collapsible rack assembly is in a collapsed position.

**11.** The collapsible rack assembly according to claim 10, wherein each midline rail has a top side rail and a bottom side rail, each having ends configured to detachably couple to the at least one vertical support.

**12.** The collapsible rack assembly according to claim 11, further comprising a pair of side rails defining the first side and the second side and defining pairs of second notches disposed between the first end and the second end.

**13.** The collapsible rack assembly according to claim 12, wherein each side rail has a top side rail and a bottom side rail, and each side rail is connected to the pair of first end rails.

**14.** The collapsible rack assembly according to claim 13, wherein the pair of first end rails extends perpendicular to the midline rail.

**15.** The collapsible rack assembly according to claim 11, further comprising: a second side midpoint region disposed on an opposing side of the midline rail from the first side midpoint region and coupled to a pair of second end rails, a first sleeve disposed at the first side midpoint region; and a second sleeve disposed at the second side midpoint region.

**16.** The collapsible rack assembly according to claim 15, wherein each first notch is formed by a first segment coupled at a first obtuse angle with a second segment, the second segment coupled at a second obtuse angle with a third segment, the third segment coupled to one of the first sleeve or the second sleeve.

**17.** The collapsible rack assembly according to claim 14, wherein each second notch is formed by a third segment coupled at a third obtuse angle with a fourth segment, the fourth segment coupled at a fourth obtuse angle with a fifth segment, the fifth segment coupled at a fifth obtuse angle with a sixth segment, the sixth segment coupled to one end rail at least one of the pair of first end rails or the pair second end rails.

**18.** A collapsible rack assembly comprising: a plurality of elongated shelves, each elongated shelf having a first side, a second side, a first end, a second end, a top side, and a bottom side and comprising: a first side rail defining the first side and extending from the top side, a second side rail defining the second side and extending from the top side, a midline rail disposed between the first side rail and the second side rail and extending from the top side such that a pair of channels are defined on the bottom side between the first side rail and the second side rail, wherein each of the first side rail, the second side rail, and the third side rail have a pair of notches disposed between the first end and the second end, a first sleeve disposed at the first end of the midline rail, and a second sleeve disposed at the second end of the midline rail.

**19.** The collapsible rack assembly according to claim 18, wherein the pairs of notches of a first elongated shelf of the plurality of elongated shelves is configured to allow at least one of the first

end or the second end of another elongated shelf to nest within the first elongated shelf when the collapsible rack assembly is in a collapsed position.

**20.** The collapsible rack assembly according to claim 19, wherein the first end and the second end are defined by at least one of the first sleeve or the second sleeve and a plurality of end members extending from first sleeve or the second sleeve toward at least one of the first side rail or the second side rail, the end members extending from the top side.

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