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### Retail shelving system

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#### Abstract

A shelving system is provided. The shelving system includes an upper rail, and optionally a lower rail, from which one or more upright supports extend. The upright supports are slidable within the upper and lower rails so that a user may vary their location. A shelf mounts to the upright supports. The shelf includes interlocking deck panels and selectively removable support bars so that it may be assembled onto the upright supports.

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## Background/Summary

**CROSS-REFERENCE TO RELATED PATENT APPLICATIONS** (1) This Patent Application is a Continuation of co-pending U.S. patent application Ser. No. 17/826,769, filed May 27, 2022, which is now pending, which is a Continuation of U.S. patent application Ser. No. 16/222,722, filed Dec. 17, 2018, which issued as U.S. Pat. No. 11,369,215 on Jun. 28, 2022, the entire teachings and disclosure of all applications are incorporated herein by reference thereto.

## **FIELD OF THE INVENTION**

(1) This invention generally relates to retail displays, and more particularly to retail shelving systems.

## **BACKGROUND OF THE INVENTION**

(2) Retail shelving is a staple in the retail merchandise environment. While such shelving comes in many forms, it generally includes a vertical support structure which supports one or more shelves extending outwardly from the vertical structure. The vertical structure is typically a wall-like structure and contains integrated mounting rails, referred to in the industry as gondola uprights, which the shelves mount to. However, the vertical structure and its gondola uprights offer minimal customization for mounting the shelves in a variety of arrangements.

(3) Further, certain retail displays may not include their own integrated gondola uprights. For non-limiting example, a refrigerated case for containing produce may not have integrated gondola uprights for a variety of reasons, one being that it may not have been originally designed to incorporate gondola mounted shelves, another being that such cases are typically designed to only accept the case manufacturers shelving and thus does not offer any customization.

(4) In such an instance, a separate grid structure that may contain gondola uprights is first mounted to a back wall of the refrigerated case. Thereafter, shelving can be mounted to this grid structure, ultimately to present a shelving arrangement similar to that for displaying non-refrigerated items. While such a configuration has a distinct advantage of allowing the retailer to introduce a shelving arrangement in a display not originally designed for shelving, it is not without its drawbacks.

(5) Indeed, the grid structure is a relatively large welded structure. Because it is welded, shipping this large structure in its pre-assembled state can be costly and cumbersome. Further, because the grid structure is a welded structure, its gondola uprights are fixed. Such grid systems typically include five fixed gondola uprights. However, the particular shelving configuration selected by the end user may necessitate the use of less than all five gondola uprights, leaving the remaining gondola uprights unused yet part of the assembly. Furthermore, the welding process necessitate the use of robust materials, which in turn results in a relatively heavy structure that tends to be difficult to install.

(6) Yet further, the shelves of such shelving systems also present several drawbacks. These shelves are typically steel structures which can corrode over time and which are heavy making them difficult to remove for cleaning. One alternative has been to utilize aluminum shelving instead, but this material results in a more costly system. Also, such steel or aluminum shelves do not meet the requirements for NSF Certification by NSF International, which is a highly desired certification in certain retail display applications in which the shelving surface comes into direct contact with the product being merchandised.

(7) Accordingly, there is a need in the art for a retail shelving system which addresses the above drawbacks of existing shelving systems. The invention provides such a retail shelving system. These and other advantages of the invention, as well as additional inventive features, will be apparent from the description of the invention provided herein.

## **BRIEF SUMMARY OF THE INVENTION**

(8) In one aspect, the invention provides shelving system. An embodiment of such a shelving system includes an upper rail defining an upper channel. The upper rail is configured to mount to a support structure. This embodiment also includes at least one upright support. The at least one upright support has an upper end and a lower end. The upper end is received in the upper channel.

The lower end is received in the lower channel. The at least one upright support is slidable in the upper channel. This embodiment also includes at least one shelf mounted to the at least one upright supports.

(9) In embodiments according to this aspect, the upper rail includes a mounting shelf. The at least one upright supports include a channel for receiving the mounting shelf.

(10) In embodiments according to this aspect, the shelving system also includes a lower rail defining a lower channel configured to mount to the support structure separately from the upper rail. The lower rail includes a bottom wall and a lip depending upwardly from the bottom wall which bound the lower channel. The lip of the lower rail includes at least one access opening. The at least one access opening allowing access through the lip of the lower rail to the lower channel. The lower end of the at least one upright support is received in the lower channel.

(11) In embodiments according to this aspect, the upper rail includes an upper wall and a lip depending downwardly from the upper wall which bound the upper channel. An extension length of the lip of the upper rail from the upper wall is less than an extension length of the lip of the lower rail from the lower wall.

(12) In embodiments according to this aspect, each of the upper and lower rails includes a pair of mounting structures for mounting the upper and lower rails to the support structure. Each of the pair of mounting rails includes a front plate and a back plate, the back plate slidable relative to the front plate.

(13) In embodiments according to this aspect, the at least one upright support includes first and second upright supports, and the shelf includes a first and a second support arm. The first support arm is mounted to one of the first and second upright supports. The second support arm is mounted to the other one of the first and second upright supports. The first and second support arms are arranged in opposed spaced relation to one another. A front support bar extends between the first and second support arms. A rear support bar extends between the first and second support arms. At least one deck panel is supported by the front and rear support bars. The at least one deck panel is configured to interlock with an adjacent deck panel such that the at least one deck panel is prevented from laterally moving relative to the adjacent deck panel along the front and rear support bars.

(14) In embodiments according to this aspect, the front and rear support arms each include a front mounting post and a rear mounting post. The front support bar includes a channel. The channel of the front support bar receives the front mounting posts of the first and second support arms such that the front support bar is selectively removable from the first and second support arms. The rear support bar also includes a channel. The channel of the rear support bar receives the rear mounting posts of the first and second support arms such that the rear support bar is selectively removable from the first and second support arms.

(15) In embodiments according to this aspect, the at least one deck panel includes a plurality of tabs extending from a bottom surface of the deck panel. The plurality of tabs are configured to be received in corresponding openings of the adjacent deck panel. The at least one deck panel includes a lip that provides a plurality of openings for receiving a plurality of tabs of the adjacent deck panel.

(16) In another aspect, the invention provides a modular shelf for a shelving system. The shelving system includes at least one rail configured to mount to a support structure, and at least one upright support extending from the at least one rail. The shelf includes a first and a second support arm arranged in opposed spaced relation to one another. At least one support bar is mounted to the first and second support arms. This embodiment of the shelf also includes at least one deck panel supported by the at least one support bar. The at least one deck panel is configured to interlock with an adjacent deck panel such that the at least one deck panel is prevented from laterally moving relative to the adjacent deck panel along the front and rear support bars.

(17) In embodiments according to this aspect, the at least one deck panel includes an integrated

baffle support and a plurality of tabs extending from a bottom surface of the deck panel. The plurality of tabs are configured to be received in corresponding openings of the adjacent deck panel. The at least one deck panel also includes a lip providing a plurality of openings for receiving a plurality of tabs of the adjacent deck panel.

(18) In embodiments according to this aspect the at least one support bar includes front and rear support bars. Each of the front and rear support bars include a channel. The channel of the front support bar receives front mounting posts of the first and second support arms such that the front support bar is selectively removable from the first and second support arms. The channel of the rear support bar receives rear mounting posts of the first and second support arms such that the rear support bar is selectively removable from the first and second support arms

(19) In embodiments according to this aspect, the at least one deck panel includes a honeycomb structure having at least one channel for receiving the at least one support bar. The at least one channel includes a plurality of finger tabs for affixing the at least one deck panel to the at least one support bar.

(20) In another aspect, the invention provides a shelving system. An embodiment of such a shelving system includes an upper rail configured to mount to a support structure, a lower rail configured to mount to a support structure, and at least two upright supports extending between the upper and lower rails. This embodiment also includes at least one shelf mounted to the at least two upright supports. The at least one shelf comprising a first and a second support arm. Each of the first and second support arms includes a front mounting post and a rear mounting post. This embodiment of a shelf also includes a front support bar extending between the first and second support arms. The front support bar includes a channel. The channel of the front support bar receives the front mounting posts of the first and second support arms such that the front support bar is selectively removable from the first and second support arms. This embodiment also includes a rear support bar extending between the first and second support arms. The rear support bar includes a channel. The channel of the rear support bar receives the rear mounting posts of the first and second support arms such that the rear support bar is selectively removable from the first and second support arms. This embodiment of a shelf also includes at least one deck panel supported by the front and rear support bars.

(21) In embodiments according to this aspect, the upper rail includes an upper channel, and the lower rail includes a lower channel. Each of the at least two upright supports has an upper end and a lower end. The upper end is received in the upper channel, and the lower end is received in the lower channel. The at least two upright supports are slidable in the upper and lower channels.

(22) In embodiments according to this aspect, the at least one deck panel is configured to interlock with an adjacent deck panel. The at least one deck panel includes a front and a rear channel for receiving the front and rear support bars, respectively.

(23) In embodiments according to this aspect, the at least one deck panel includes opposed side edges. A plurality of tabs extend from a bottom surface adjacent one of the opposed side edges of the deck panel. The at least one deck panel includes a lip adjacent the other one of the opposed side edges. The lip provides a plurality of openings for receiving a plurality of tabs of the adjacent deck panel.

(24) In another embodiment, the invention provides a method of installing a shelving system. An embodiment of such a method includes mounting an upper rail having an upper channel to a support structure, mounting at least one upright support having an upper end and a lower end to the upper rail such that the upper end of the first upright support is disposed within the upper channel, mounting a first support arm of a at least one shelf to the at least one upright support, mounting a second support arm of the at least one shelf to the at least one upright support, situating at least one support bar such that it extends between the first and second support arms, and affixing a first deck panel onto the at least one support bar.

(25) In embodiments according to this aspect, the step of mounting the at least one upright support

includes mounting a first and a second upright support to the upper rail, and further includes linearly inserting the upper end of each of the first and second upright supports into the upper channel, and sliding the first and second upright supports into first and second positions, respectively.

(26) In embodiments according to this aspect, the method also includes separately mounting a lower rail having a lower channel to the support structure below the upper rail. Mounting the at least one upright support includes mounting the at least one upright support to the upper and lower rails such that the upper end is received in the upper channel and the lower end is received in the lower channel. The method also includes rotating the at least one upright support such that the lower end thereof passes through an opening in the lower mounting rail to seat within the lower channel.

(27) In embodiments according to this aspect, the step of situating the at least one support bar includes situating front and rear support bars on a mounting post of each support arm within a channel of each support bar.

(28) In embodiments according to this aspect, the method also includes affixing a second deck panel onto the at least one support bar such that the first and second deck panels interlock.

(29) Other aspects, objectives and advantages of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

(1) The accompanying drawings incorporated in and forming a part of the specification illustrate several aspects of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:

(2) FIG. 1 is a perspective view of an exemplary embodiment of a retail shelving system according to the teachings herein;

(3) FIG. 2 is a perspective exploded view of a grid assembly of the retail shelving system of FIG. 1;

(4) FIG. 3 is a perspective view of an upper rail of the grid assembly of FIG. 2;

(5) FIG. 4 is a perspective view of a lower rail of the grid assembly of FIG. 2;

(6) FIG. 5 is a perspective cross section of the grid assembly of FIG. 2, taken in a region of the upper rail;

(7) FIG. 6 is a perspective cross section of the grid assembly of FIG. 2, taken in a region of the lower rail;

(8) FIG. 7 is a perspective view of the upper rail of the grid assembly of FIG. 2 receiving an upper end of an upright support;

(9) FIG. 8 is a perspective view of the lower rail of the grid assembly of FIG. 2 receiving a lower end of the upright support depicted in FIG. 7;

(10) FIG. 9 is a perspective view of a mount of the grid assembly of FIG. 2;

(11) FIG. 10 is another perspective view of the mount of FIG. 9, shown in an alternate position;

(12) FIG. 11 is another perspective view of the mount of FIG. 9, showing a side thereof opposite that shown in FIG. 9;

(13) FIG. 12 is a perspective partially exploded view of a shelf of the shelving system of FIG. 1;

(14) FIG. 13 is another perspective partially exploded view of the shelf of FIG. 12, shown in relation to the grid assembly of FIG. 2;

(15) FIG. 14 is a cross section of a portion of the shelf of FIG. 12;

(16) FIG. 15 is a perspective exploded view of a support arm of the shelf of FIG. 12;

(17) FIG. 16 is a side view of the support arm of FIG. 15;

(18) FIG. 17 is another side view of the support arm of FIG. 15, showing an alternate configuration

thereof from that shown in FIG. 16;

(19) FIG. 18 is a perspective view of a deck panel of the shelf of FIG. 12; and

(20) FIG. 19 is perspective view of an overlapped joint formed between adjacent deck panels.

(21) While the invention will be described in connection with certain preferred embodiments, there is no intent to limit it to those embodiments. On the contrary, the intent is to cover all alternatives, modifications and equivalents as included within the spirit and scope of the invention as defined by the appended claims.

#### DETAILED DESCRIPTION OF THE INVENTION

(22) Turning now to the drawings, the same illustrate an embodiment of a shelving system according to the teachings herein. As will be understood from the following, the shelving system provides several advantages over existing designs. First, it utilizes an upper rail and a lower rail which are separately mountable from one another. A number of upright supports are slidably received by these upper and lower rails. As a result, an installer can easily mount the upper rail, then mount the lower rail, and then slide the upright supports into the rails. This is a distinct departure from prior designs which employ a grid structure that is welded together as a one piece unit.

(23) Second, the shelving system according to the teachings herein utilizes shelves which may be assembled onto the upright supports once they are installed. This is a distinct advantage over prior designs which require lifting a shelf as a unit onto a grid structure. Instead, according to the teachings herein, the shelf is rapidly assembled piece by piece in place. As a result, relatively light parts are lifted during installation, which are also far less cumbersome. Third, the shelf or shelves of the current application utilize plastic deck panels which may be formed of a NSF compliant material. Fourth, because both the rails, the upright supports, and shelf or shelves are designed to be assembled during installation, they may be shipped in a much smaller container than in prior designs. Fifth, due to the size and modular nature of the deck panels, these panels may be easily removed for cleaning in a sink or dishwasher. This is a distinct advantage over prior designs, which require removing the entirety of the shelf as a single unit and washing the same in a cleaning area which accommodates cleaning of relatively large objects. These and other advantages will become more apparent from the disclosure herein.

(24) With specific reference now to FIG. 1, the same illustrates an exemplary embodiment of a shelving system 100 according to the teachings herein. Shelving system 100 includes a grid assembly with one or more shelves 108 mounted thereto. While one shelf 108 is shown, it is contemplated that any number of shelves may be mounted to this grid assembly. Further, while shelf 108 illustrated the full length of the grid assembly, shorter shelf lengths are entirely possible due to the highly customizable nature of the grid assembly and through the use of a common and modular deck panel as discussed below.

(25) The grid assembly itself consists of a number of separate and distinct components which will be discussed in turn. As mentioned above, this approach of having separate components has a distinct advantage over grid structures of prior designs which are a welded structure which is relatively large and cumbersome.

(26) The grid assembly includes an upper rail 102 and a separate lower rail 104. Upper and lower rails 102, 104 are configured to mount to a support structure such as a vertical wall, the interior of a refrigerated or freezer case, etc. Indeed, upper and lower rails 102, 104 may be adapted to mount to any structure capable of supporting the same. As such, upper and lower rails 102, 104 may incorporate any mounting expedient.

(27) One advantageous feature of upper and lower rails 102, 104 is that they are separate components. As a result, they may be separately installed to the aforementioned support structure. This makes installation considerably easier than in prior designs which require lifting a large welded grid structure as a single unit and installing it in place on a support structure.

(28) A plurality of upright supports 106a, 106b, 106c are slidably received in upper and lower rails



**102, 104.** As will be explained below, rails **106a-c** are used for mounting shelf **108** thereto. It should be noted that three upright supports **106a-c** are illustrated for purposes of description. However, only the outer most upright supports **106a, 106c** are needed for mounting the illustrated shelf **108**. Multiple additional shelves **108** may mount to the same two upright supports **106a, 106c** below shelf **108** as illustrated. Further, shelves **108** having a shorter length may be mounted between upright supports **106a** and **106b**, or between upright supports **106b** and **106c**. Unless otherwise specifically noted herein, any description of the structure, function, or use of one upright support **106a-c** applies equally to the others.

(29) One advantage having separate upright supports **106a-c** is the ability to add or remove a desired number of upright supports as discussed below to allow for a specific shelving configuration. This is a distinct departure from prior welded designs as discussed above. In such welded designs, a fixed number of upright supports are provided, making customization difficult. The number of upright supports which may be included in the current application will be entirely dependent upon the shelving configuration desired. Therefore, the three upright supports **106a-c** should be taken as only one of many possible examples. While two rails **102, 104** are shown and described, it is contemplated that only a single upper rail **102** could be utilized for receiving and supporting upright supports **106a-c**.

(30) Turning now to FIG. 2, once upper and lower rails **102, 104** are installed, each upright support **106a-c** is installed by generally situating the upright supports **106a-c** into upper and lower rails **102, 104** by moving them generally in direction **110**, and then sliding them in direction **112** to their final destinations. Upper and lower rails **102, 104** are designed such that they each include a channel within which the end portions of the upright supports **106a-c** are situated and slidable in.

(31) Indeed, referring specifically to upright support **106a** shown in FIG. 2, the same includes an upper end **114** and a lower end **116**. A plurality of apertures **118** are formed therein for shelf mounting. These apertures **118** may take on any shape. An identical description to that of upright support **106a** applies to **106c**. Upright support **106c** differs only in that it include two parallel rows of apertures **118** as illustrated.

(32) Turning now to FIG. 3, the same illustrates upper rail **102**. Upper rail **102** includes a rail section **120** with a pair of identical mounting brackets **122a, 122b** at opposed ends of rail section **120**. Rail section **120** includes a channel **124** within which the upper end **114** of each upright support **106a-c** is slidable. Further, rail section **120** also includes a mounting shelf **126** upon which each upright support **106a-c** mates. This configuration ensures that upright supports **106a-c** are at a uniform height relative to one another so that the apertures **118** horizontally align.

(33) Rail section **120** includes a lip **128** which depends downwardly from an upper wall **130** of rail section **120**. This lip **128**, upper wall **130**, and mounting shelf **126** bound channel **124**. The particular length of upper rail **102** shown should be taken by way of example only. Indeed, the length of upper rail **102** may be varied depending upon the desired sizing of shelving system **100**.

(34) Turning now to FIG. 4, the same illustrates lower rail **104**. Lower rail **104** also includes a rail section **140**. The same pair of identical mounting brackets **122a, 122b** used in upper rail **102** (see FIG. 3) are also used in lower rail **104** as shown. Rail section **140** also includes a channel **144** within which the lower end **116** of each upright support **106a-c** is slidable. An opening **146** is formed in rail section **140**. This opening **146** allows passage of lower end **116** (see FIG. 2) of each upright support **106a-c** from an exterior of rail section **140** into channel **144** as discussed below.

(35) Rail section **140** includes a lip **148** which depends upwardly relative to a lower wall **150** of rail section **140**. This lip **148** and lower wall **150** bound channel **144**. The particular length of lower rail **104** shown should be taken by way of example only. Indeed, the length of lower rail **104** may be varied depending upon the desired sizing of shelving system **100**. Further, lip **148** retains lower end **116** of upright supports **106a-c** when situated in channel **144**, preventing them from rocking away from a support structure upon which rails **102, 104** are mounted.

(36) Turning now to FIG. 5, the same illustrates a cross section in the region of the upper end **114**

of upright support **106b** when it is situated within channel **124**. As may be seen in this view, upper end **114** closely resembles the shape of channel **124** to minimize relative movement between these structures. As may also be seen in this view, upright supports **106a-c** each include a channel **152** which receives mounting shelf **126** as shown.

(37) Likewise, and as is shown in FIG. 6, lower end **116** closely resembles the shape of channel **144** to minimize relative movement between these structures. Lower end **144** may rest on bottom wall **150** as shown, or it may be spaced away from bottom wall **150**. Indeed, the support provided by mounting shelf **126** (see FIG. 5) is sufficient to allow upright supports **106a-c** to hang freely therefrom.

(38) FIGS. 7 and 8 illustrate a typical installation operation of uprights supports **106a-c**. As shown in FIG. 7, upright support **106a** is brought into proximity with upper rail **102** and angled as shown. Upright support **106a** is then moved in linear direction **154** as shown until upper end **114** is partially situated within channel **124**. Thereafter, and referring now to FIG. 8, upper rail is then rotated about its upper end **114** to pivot lower end **116** in direction **156** as shown. Doing so causes lower end **116** to pass through aperture **146** in rail section **140** of lower rail **104**. This operation ultimately places lower end within channel **144**. Once within channels **124**, **144**, upright support **106a** may be slid in directions **160**, **162** to its desired location. A successive operation as described above is undertaken for each upright support installed in upper and lower rails **102**, **104**. It is also contemplated that the above process could be reversed relative to upper and lower rails **102**, **104**. Indeed, upright supports **106a-c** could be installed into lower rail **104** first in the same manner as they are installed into upper rail **102** described above, and then installed into upper rail **102** in the same manner as they are installed into lower rail as described above. It is thus contemplated that the structure and function of upper and lower rails **102**, **104** could be swapped.

(39) Turning now to FIG. 9, the same illustrates an exemplary view of mounting bracket **122b**. As noted above, mounting bracket **122b** is identical to mounting bracket **122a**. Mounting bracket **122b** includes a movable plate **164** providing mounting features **168** for mounting to a support structure, and a fixed plate **166**. Fixed plate **166** is fixed to its associated rail section **120**, **140**, while movable plate **164** is slidable relative to fixed plate **166**. Movable plate **164** includes a pin **170** which is received in a slot **172** of fixed plate **166**.

(40) Turning now to FIG. 10, this pin and slot configuration defines the amount of lateral travel movable plate **164** may undergo relative to fixed plate **166** before movable plate **164** is effectively separated from fixed plate **166**. As an example in FIG. 10, movable plate **164** has moved in direction **174** relative to fixed plate **166**. Such a slidable configuration allows the mounting brackets **122a**, **122b** to accommodate for deviations in corresponding mounting holes in a support structure arranged to receive mounting features **168**. With momentary reference to FIG. 11, pin **170** attached to movable plate **164** via a leave spring **176** which may be deflected to such an extent to allow for full separation of movable plate **164** from fixed plate **166**.

(41) Turning now to FIGS. 12-19, the same illustrate shelf **108** in greater detail. With particular reference to FIG. 12, shelf **108** includes a plurality of identical deck panels **180a**, **180b**, **180c**, **180d**. Given that deck panels **180a-d** are identical, a description of any of one of said deck panels **180a-d** applies equally well to the others. Although four deck panels **180a-d** are shown to accommodate for the full length of shelf **108** illustrated, shorter shelves **108** will have fewer deck panels. For example, a shelf **108** half as long as that illustrated in FIG. 12 would only have two deck panels. Further, it is also contemplated that a shelf **108** may include a single deck panel. As will be discussed below, where multiple deck panels **180a-d** are utilized, adjacent deck panels interlock with one another to prevent lateral movement of these deck panels **180a-d** relative to one another. As one non-limiting example, each deck panel **180a-d** may be one foot wide. A four foot long shelf would thus employ four deck panels. Although illustrated as mounting the grid assembly discussed above relative to FIGS. 1-11, it is contemplated that shelf **108** may be configured to mount to any existing structure by minor modification of the structure it utilizes for mounting. More generally, it

is contemplated by the teachings herein, that the invention may be embodied as a combined system as reflected in FIG. 1 for example, or as a stand alone shelf **108** that may be retrofit into an existing system.

(42) Each deck panel **180a-d** includes an upper surface **210** which is used to support merchandise. Further, deck panels **180a-d** may include perforations as shown, or any other features typical of retail shelving, e.g. features for mounting a front fence **186** as shown, features for mounting dividers (not shown), a price channel or price channel support **232** (see FIG. 18), channels or other features for receiving and retaining lighting elements, etc. Deck panels **180a-d** may be formed of a plastic material, for example, an acrylonitrile butadiene styrene (ABS) plastic. Such a material selection allows for the use of NSF certified materials for contacting retail items such as produce or the like.

(43) As illustrated in FIG. 12, the front fence **186** of the illustrated example extends parallel to a horizontal axis. The front fence **186** has width that is wider than the width of the individual deck panels **180a-d** such that the front fence **186** extends across a plurality of the deck panels **180a-d**. In this example, the width of the front fence **186** is approximately the width of all four adjacent deck panels **180a-d**.

(44) As illustrated in FIG. 12, the front fence **186** includes a horizontally extending top wire portion **187**, a horizontally extending bottom wire portion **189** that is spaced from the top wire portion **187**, an intermediate wire portion **191** that zig-zags between and is connected to the top and bottom wire portions **187**, **189**.

(45) The front fence **186** includes a plurality of vertically directed wire portions **193** that extend downward below the bottom wire portion **189** and in a direction away from the top wire portion **187**. In this example, each deck panel **180a-d** has at least one vertical wire portion **193** adjacent thereto.

(46) When the deck panels **180** and front fence **186** are installed, intermediate portions **195** of the bottom wire portion **189** between adjacent ones of the vertically directed wire portions **193** extend across the interface formed by adjacent edges of adjacent deck panels, see for example, the intermediate portion **195** that extends across the interface between adjacent deck panels **180a** and **180b**.

(47) With additional reference to FIG. 1, when assembled, the front fence **186** is positioned rearward of a front walls that define price channel supports **232** of the deck panels **180a-d**. The front fence **186** is positioned forward of the front support bar **184** such that the front fence **186** is positioned between the front walls of the deck panels **180a-d** and the front support bar **184**.

(48) Further, because deck panels **180a-d** are separable and removable from the remainder of shelf **108**, they may be easily cleaned in a dishwasher, sink, etc. Further, although illustrated as forming a portion of a flat shelf, deck panels **180a-d** may take on other forms. For example, deck panels **180a-d** may be embodied as bins or any other expedient typically used in the retail environment for containing merchandise. Yet further, although not illustrated, pusher systems and other front facing devices may be readily mounted to deck panels **180a-d**.

(49) Still referring to FIG. 12, in addition to deck panels **180a-d**, shelf **108** includes first and second support arms **182** arranged at opposed sides of shelf **108**. Support arms **182** are mirror images of one another, so a description of one applies equally well to the other. Shelf **108** also includes front and rear support bars **184** which are also identical to one another.

(50) Turning now to FIG. 13, shelf **108** is rapidly installable to the above described grid assembly by the following general process. First, each support arm **182** is mounted to a respective upright support **106a-c**. In the illustrated embodiment the left-most support arm **182** is mounted to upright support **106a**, and the right-most support arm **182** is mounted to upright support **106c**. Thereafter, each support bar **184** is installed by moving the same generally in direction **190** until a support post **188** of each support arm **182** is situated within a channel of each support bar **164** as discussed below. Once support bars **184** are in place, each deck panel **180a-d** is then successively affixed in

place to support bars **184** as discussed below.

(51) Alternatively, where support bars **184** are closed profile tubular elements, it is also contemplated that each support bar **184** is installed by horizontally sliding it onto the mounting post **188** of each support arm **182**. Such an operation may be done prior to installing support arms **182** onto their associated upright support. Further, although a front and rear support bar **184** are shown, it is contemplated that for deeper shelf lengths, additional support bars **184** intermediate of front and rear support bars **184** could be utilized as well. Likewise, it is also contemplated that shallower shelf depths may only require a single support bar **184**. As such, it is contemplated that at least one support bar **184** may be utilized for supporting the deck panel or panels **180a-d** of shelf **108**.

(52) Still further, although shelf **108** is described as mounting to two separate upright supports **106a**, **106c**, it is contemplated that shelf **108** may mount to a single upright support. Such a single upright support may be wider than those shown to accommodate mounting multiple support arms **182**. For example, shelf **108** may mount to upright support **106b** alone. Upright support **106b** includes a double row of apertures **118** and can thus accommodate two support arms. The overall width of such a single upright support **106b** may be varied to accommodate varying shelf lengths. As such, it is contemplated that at least one upright support is all that is required at a minimum for shelf mounting.

(53) It will be recognized from the foregoing that all of the componentry of shelf **108** may be readily assembled and disassembled without the use of any special tools, or without destroying or disfiguring any portion of shelf **108**. Such a configuration is a distinct departure from prior designs which typically employ welded structures for their shelves, making the same heavy and generally cumbersome when the same are installed, or periodically removed for cleaning.

(54) It will also be recognized from the foregoing, that shelf **108** presents a highly modular design. Indeed, as one non-limiting example, shelf **108** may be readily adapted to a shelf having half of the length shown by remounting one of support arms **182** on upright support **106b**, and utilizing shorter support bars **184**. Thereafter, two deck panels (instead of the four shown) can then be snapped onto these shorter support bars **184**.

(55) FIG. **14** illustrates a cross section taken in the region of the interface between a mounting post **188** of the left-most support arm **182** shown in FIG. **13** and rear support bar **184**. As can be seen in this view, mounting post **188** is situated within a channel **196** of support bar **184**. An identical configuration exists at the other end of this support bar **184**, as well as at both ends of the front support bar **184** shown in FIG. **13**. Each support bar **184** is supported by two mounting posts **188** by resting upon the same, without being permanently attached to these mounting posts **188**, and thus presents a selectively removable style of assembly. It is also contemplated that channel **196** of each support bar **184** may be open sided as shown, or may be partially or fully enclosed in the event that support bars **184** are partially or entirely tubular elements, as opposed to having a generally U-shaped cross section as shown.

(56) With reference now to FIG. **15**, the same illustrates an exploded view of a support arm **182**. Each support arm **182** includes a main body **194** and an adjustable plate **198** mounted to main body **194**. Each mounting post **188** is fixed to, and depends from, main body **194** as shown. Adjustable plate **198** attaches to main body **194** via a threaded fastener **200** as shown. Threaded fastener **200** extends through an aperture **202** of main body **194** and a wing nut or the like may then be used to tighten main body **194** and adjustable plate **198** together. Adjustable plate **198** also includes mounting features **204** which are received in the apertures **118** of upright supports **106a-c** (see e.g. FIG. **2**). These mounting features **204**, however, can take any suitable form so as to facilitate the mounting of shelf **108** to any pre-existing structure.

(57) Adjustable plate **198** also includes a pin **206** which is received in one of a plurality of apertures **208** (see FIG. **16**) formed in main body **194**. The angular presentation of each support arm **182** as it extends outwardly in a cantilevered manner from its associated upright support **106a-c** is governed which of the apertures **208** pin **206** is received in. For example, as may be seen in

FIG. 16, when pin 206 is received in the upper most aperture 208, main body 194 is essentially level, e.g. horizontal, compared to adjustable plate 198. However, by removing any hardware securing fastener 200, one may reposition adjustable plate 986 relative to main body 194 (or vice versa) and insert pin 206 into a different one of apertures 208.

(58) For example, and turning now to FIG. 17, the same illustrates pin 206 in the third aperture down on main body 194. This causes main body, and hence support bars 184 and deck panels 180a-d mounted to supports bars 184 to, to tilt as shown. As a result, by this expedient manipulation, the user can readily govern the angle of shelf 108. Such a configuration is advantageous, for example, where the user desires to angle shelf 108 to provide a gravity feed function.

(59) FIG. 18 illustrates another perspective view of deck panel 180a, and in particular shows a bottom surface 112 thereof. Deck panel 180a includes a honeycomb strengthening structure 214 depending from its bottom surface 212. A front and a rear channel 216 extend through this honeycomb structure 214 for receiving each support bar 184, respectively, therein. Each channel 216 includes finger tabs 218 which may snap around its associated support bar 184 to secure deck panel 180a to support bars 184. Although a front and rear channel 214, 216 are shown, the number of channels utilized may be varied to accommodate fewer or greater support bars 184.

(60) Further, deck panel 180a also includes a wire baffle support 230 for mounting a baffle plate thereto. Such a baffle plate may take on any form useful for directing air flow in a desired path. This wire baffle support 230 is slidable relative to deck panel 180a to allow for selective positioning of such a baffle plate.

(61) The above introduced interlocking capability of deck panels 180a-d is achieved via interlocking features arranged adjacent opposed side edges of each deck panel 180a-d. In the example of deck panel 180a shown, these interlocking features include a plurality of tabs 220 adjacent one side edge which extend downwardly from bottom surface 212 as shown. These interlocking features also include a lip with a plurality of openings 222 arranged adjacent the other side edge as shown. Tabs 220 are received in openings 222 of an adjacent deck panel. Likewise, openings 222 receive tabs 220 of an adjacent deck panel. This interlocking feature ensures that adjacent deck panels cannot laterally move along support bars 184 relative to one another once interlocked. Although described as identical, it is also contemplated that end panels may be employed as the left-most and/or right-most panels in the row of interlocked deck panels. In the case of a right-most end panel, the same would omit the lip and openings 222 to provide a cleaner edge on the right most side of the shelf surface. In the case of the left-most end panel, the same would omit the tabs 220 for the same purpose.

(62) FIG. 19 illustrates one tab 220 interlocked in one opening 222. Tabs 220 vertically enter openings 222. Once situated, tabs 220 are horizontally constrained within openings 222 due to their complimentary dove-tail shape. As a result, adjacent deck panels cannot laterally move along support bars 184 relative to one another once interlocked.

(63) All references, including publications, patent applications, and patents cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

(64) The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) is to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms “comprising,” “having,” “including,” and “containing” are to be construed as open-ended terms (i.e., meaning “including, but not limited to,”) unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly

contradicted by context. The use of any and all examples, or exemplary language (e.g., “such as”) provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

(65) Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

## Claims

1. A shelf comprising: a frame including: first and second support arms; a front support bar extending parallel to a horizontal axis and between the first and second support arms; and a rear support bar extending parallel to the horizontal axis and between the first and second support arms, the rear support bar being positioned rearward of the front support bar; a plurality of deck panels including a first deck panel and a second deck panel, the second deck panel being positioned horizontally adjacent the first deck panel, the plurality of deck panels being supported by the front and rear support bars, the first deck panel having a first width measured parallel to the horizontal axis, each deck panel being plastic, the first deck panel having a first upper support surface for supporting merchandise, the first upper support surface defining a first edge, the second deck panel has a second upper support surface for supporting merchandise, the second upper support surface defining a second edge, the first and second edges are adjacent to one another at an interface between the first and second deck panels; a front fence extending parallel to the horizontal axis, the front fence having a second width measured parallel to the horizontal axis, the second width being greater than the first width such that the front fence engages at least two of the plurality of deck panels, the front fence including: a top wire portion extending horizontally; a bottom wire portion extending horizontally, the bottom wire portion being spaced from the top wire portion; an intermediate wire portion that is positioned between the top and bottom wire portions, the intermediate wire portion zig-zags between the top and bottom wire portions, the intermediate wire portion being connected to the top wire portion in a plurality of locations and being connected to the bottom wire portion in a plurality of locations; a plurality of vertically directed wire portions that extend downward below the bottom wire portion and away from the top wire portion, a first vertically directed wire portion of the plurality of vertically directed wire portions being adjacent the first deck panel and a second vertically directed wire portion of the plurality of vertically directed wire portions being adjacent the second deck panel, an intermediate section of the bottom wire portion extends horizontally between the first and second vertically directed wire portions, the intermediate section extends across the first and second edges and the interface between the first and second deck panels; and when the first deck panel, second deck panel, front fence and frame are assembled, with the front fence engaged with the first and second deck panels, the first and second deck panels are horizontally interlocked with one another.

2. A shelf comprising: a frame including: a front support bar extending parallel to a horizontal axis; and a rear support bar extending parallel to the horizontal axis, the rear support bar being positioned rearward of the front support bar; a plurality of deck panels including a first deck panel and a second deck panel, the second deck panel being positioned horizontally adjacent the first deck panel, the plurality of deck panels being supported by the front and rear support bars, the first deck

panel having a first width measured parallel to the horizontal axis, the first deck panel having a first upper support surface for supporting merchandise, the first upper support surface defining a first edge, the second deck panel having a second upper support surface for supporting merchandise, the second upper support surface defining a second edge, the first and second edges are adjacent to one another at an interface between the first and second deck panels; and a front fence extending parallel to the horizontal axis, the front fence having a second width measured parallel to the horizontal axis, the second width being greater than the first width such that the front fence engages at least two of the plurality of deck panels, the front fence includes: a top wire portion extending horizontally; a bottom wire portion extending horizontally, the bottom wire portion being spaced from the top wire portion, the bottom wire portion has an intermediate section that extends horizontally between the first and second vertically directed wire portions, the intermediate section extends across the first and second edges and the interface between the first and second deck panels; an intermediate wire portion positioned between the top and bottom wire portions, the intermediate wire portion zig-zags between the top and bottom wire portions, the intermediate wire portion being connected to the top wire portion in a plurality of locations and the intermediate wire portion being connected to the bottom wire portion in a plurality of locations; a plurality of vertically directed wire portions that extend downward from the bottom wire portion and away from the top wire portion, a first vertically directed wire portion of the plurality of vertically directed wire portions being adjacent the first deck panel and a second vertically directed wire portion of the plurality of vertically directed wire portions being adjacent the second deck panel.

3. The shelf of claim 2, wherein: the first deck panel has a first upper support surface for supporting merchandise, the first deck panel has a first front wall that defines a first front face that faces away from the front and rear support bars; the second deck panel has a second upper support surface for supporting merchandise, the second deck panel has a second front wall that defines a second front face that faces away from the front and rear support bars; the front fence being positioned rearward of the first and second front faces.

4. The shelf of claim 3, wherein: the front fence is positioned between the first front wall and the front support bar; the front fence is positioned between the second front wall and the front support bar; the rear support bar is positioned rearward of the front support bar.

5. The shelf of claim 2, wherein: when the shelf is fully assembled, the front fence engages the first and second deck panels; and when the shelf is fully assembled, the first and second deck panels are horizontally interlocked with one another.

6. The shelf of claim 2, wherein: when the first deck panel, second deck panel, front fence and frame are assembled, the front fence engages the first and second deck panels; when the first deck panel, second deck panel, front fence and frame are assembled, the first and second deck panels are horizontally interlocked with one another.

7. The shelf of claim 2, wherein the second deck panel has a third width measured parallel to the horizontal axis, the third width being less than the second width.

8. The shelf of claim 7, wherein the second width is greater than the first width plus the third width.

9. The shelf of claim 8, wherein the third width is equal to the first width.

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