US 20150023000A1

(19) **United States**

(12) **Patent Application Publication**

KENDALL et al.

(10) **Pub. No.: US 2015/0023000 A1**

(43) **Pub. Date: Jan. 22, 2015**

(54) **LIGHTED REFRIGERATOR SHELF WITH OVERMOLD**

(71) Applicant: **Whirlpool Corporation**, Benton Harbor, MI (US)

(72) Inventors: **JAMES W. KENDALL**, Mt. Propsect, I (US); **MATTHEW P. EBROM**, Holland, MI (US); **ERIC ANDREW HILL**, Holland, MI (US); **TIMOTHY T. MURPHY**, Holland, MI (US); **HARI NAIR**, St. Joseph, MI (US); **BRIAN N. RADFORD**, Stevensville, MI (US)

(21) Appl. No.: **13/944,071**

(22) Filed: **Jul. 17, 2013**

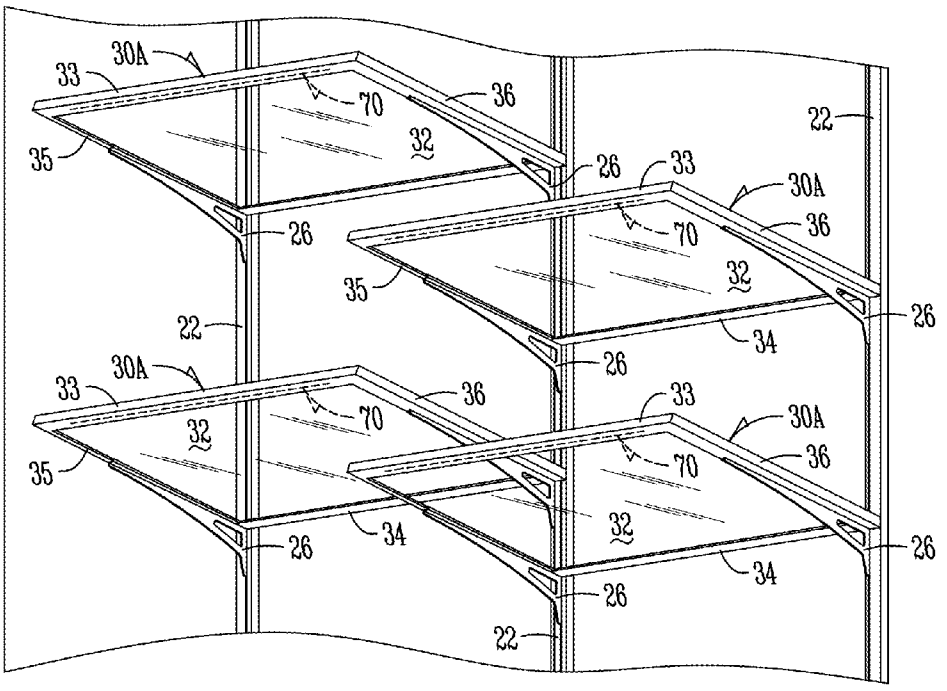
Publication Classification

(51) **Int. Cl.**
F25D 27/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F25D 27/00*** (2013.01)
USPC ... **362/92**; 362/249.01; 362/249.02; 362/231; 29/592.1

(57) **ABSTRACT**

A shelf for supporting items including but not limited to in refrigerated appliances includes in an integrated fashion a supporting surface and around the perimeter of the supporting surface of similar dimensions. A lighting subassembly is mountable to or integrated in the framing. Electrical power can be through touchless or contact electrical communication. In one form the supporting surface is a single substantially clear plate. In another form the supporting surface is a thin glass top layer and a bottom layer overmolded with the framing to the thin glass top layer.



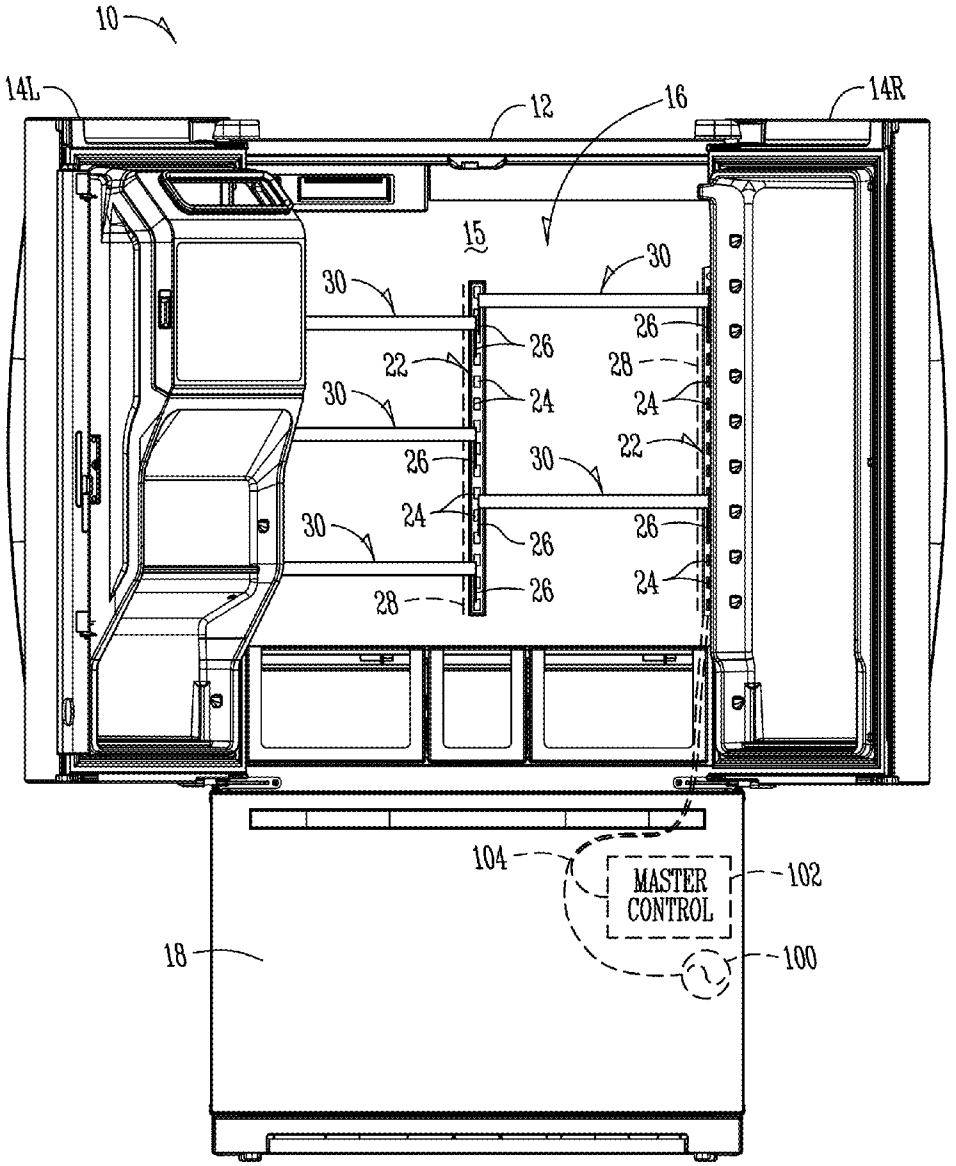


Fig. 1

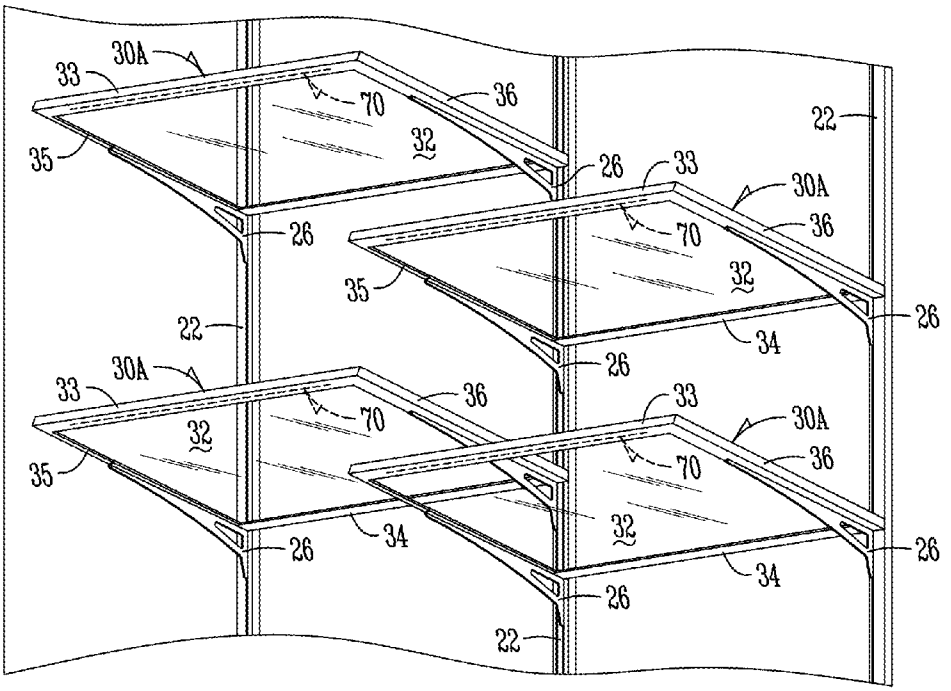


Fig. 2A

FIG. 2B

FIG. 2C

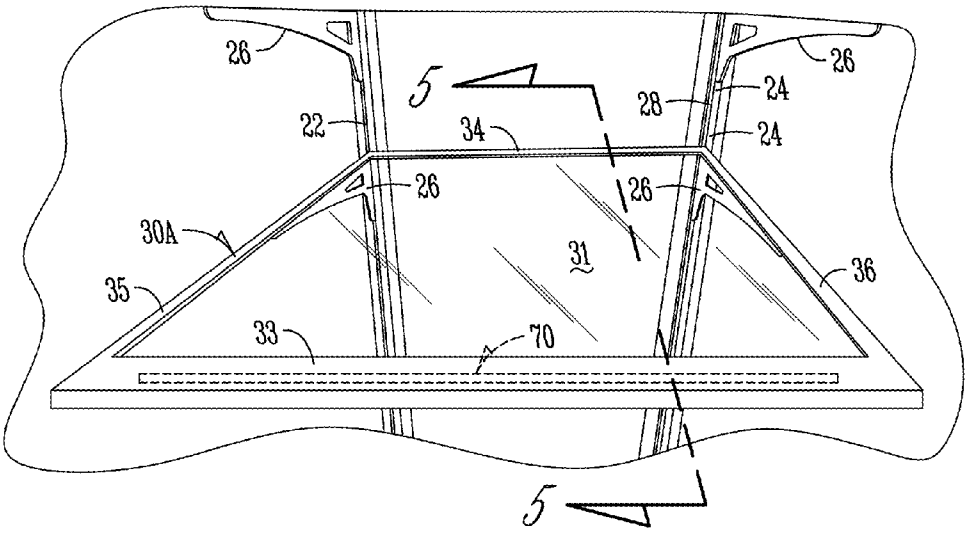


Fig. 3A

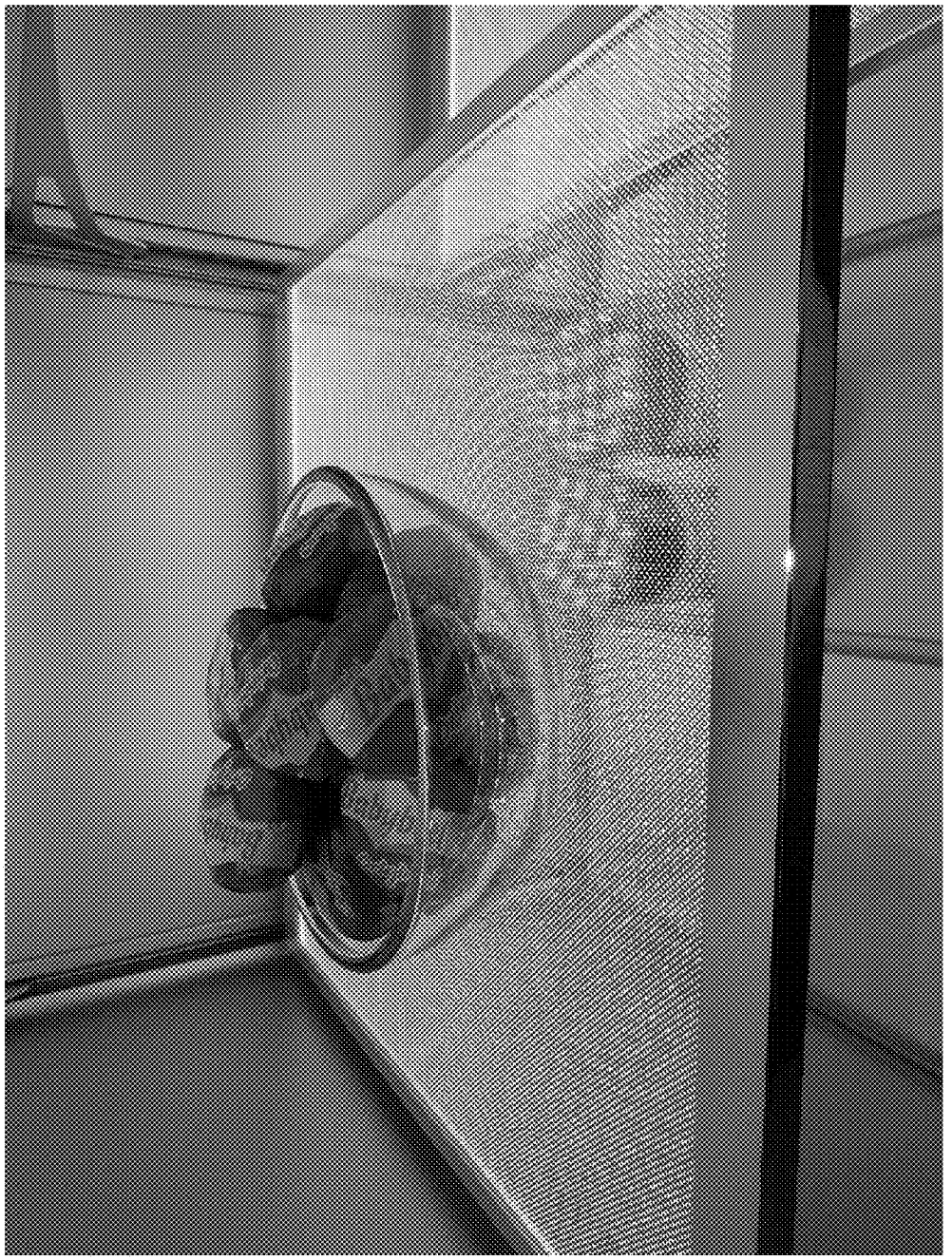


FIG. 3B

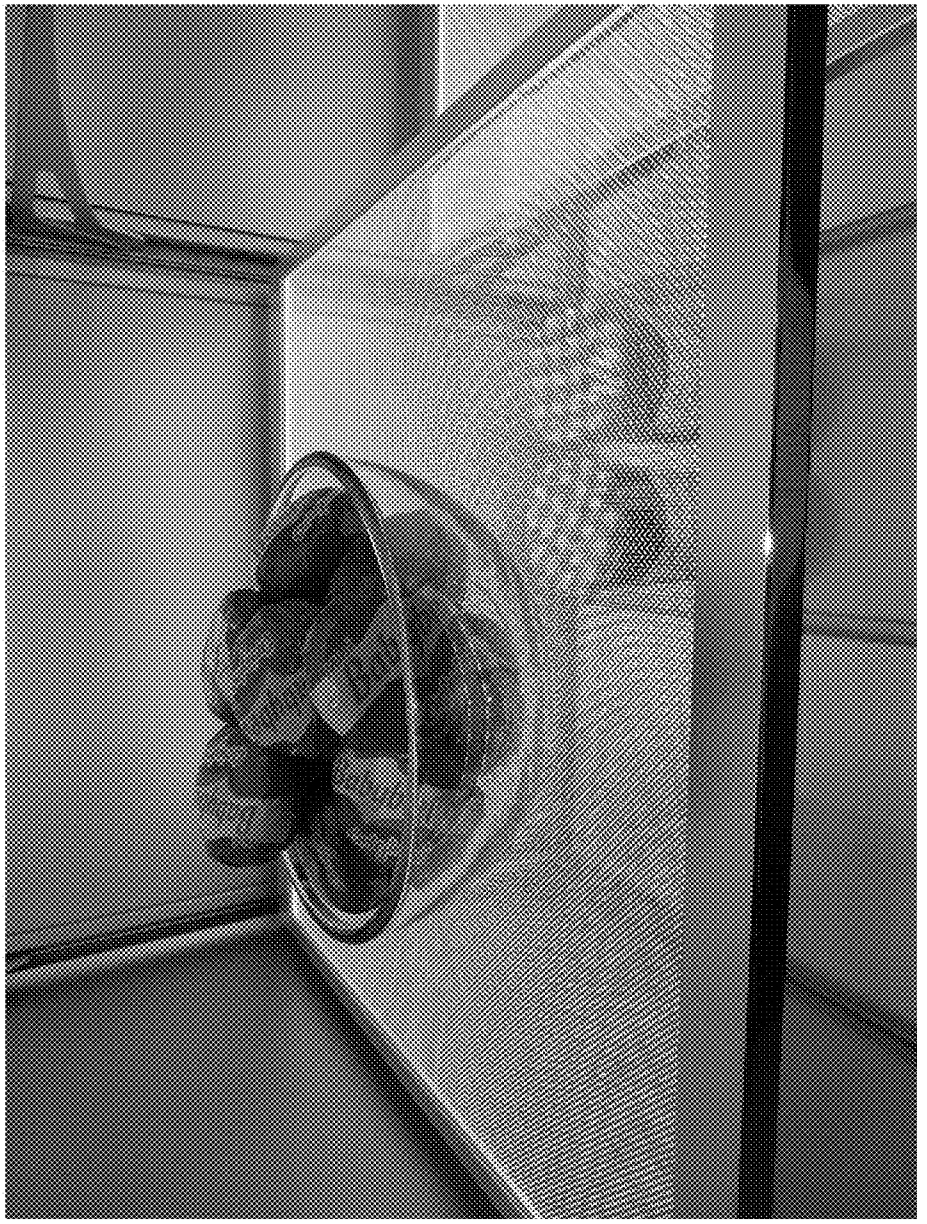


FIG. 3C

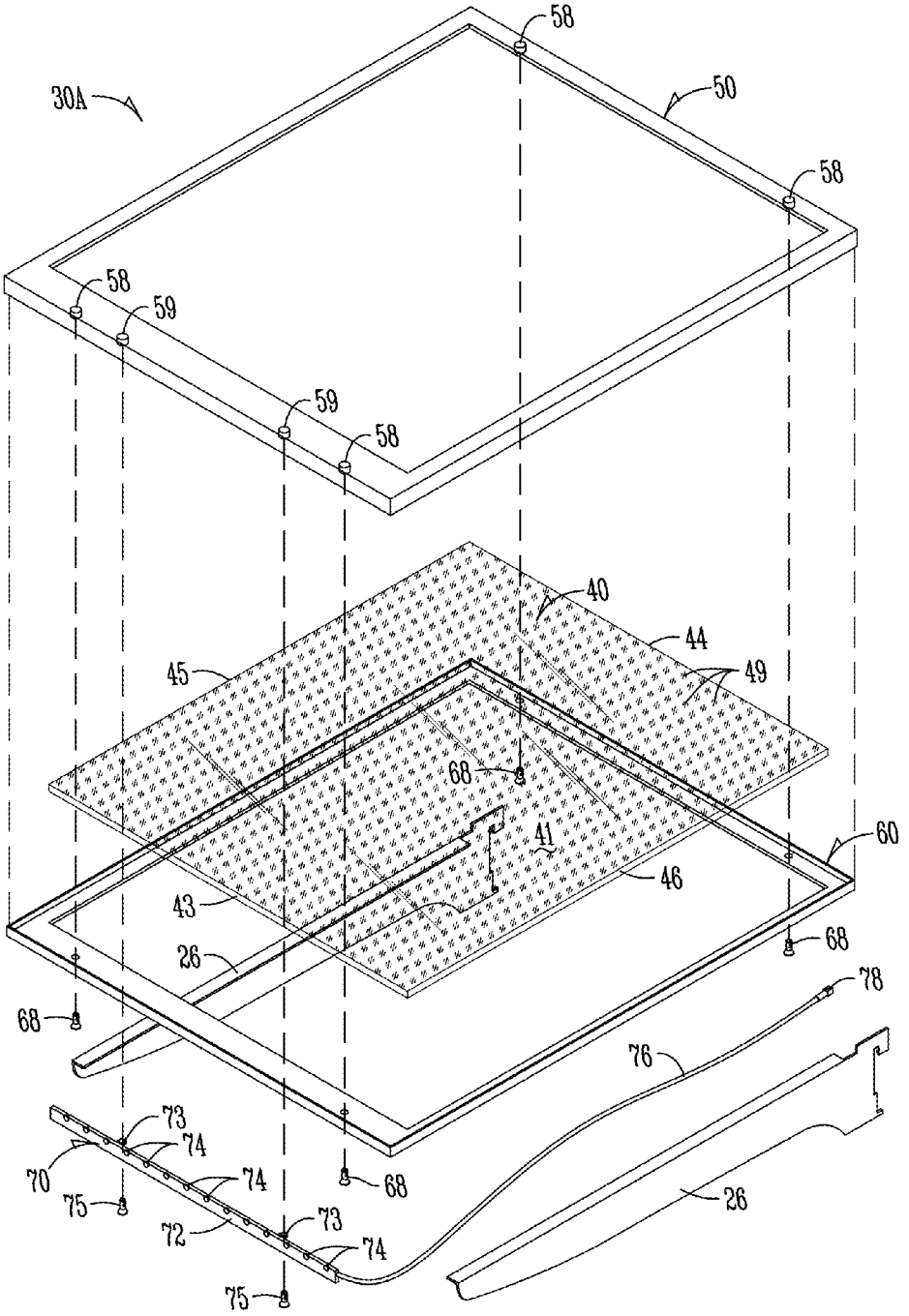

30A
58
50
58
58
59
59
58
40
44
45
49
68
41
60
46
43
26
68
68
78
76
73
74
70
74
75
68
72
73
74
75
26

Fig. 4

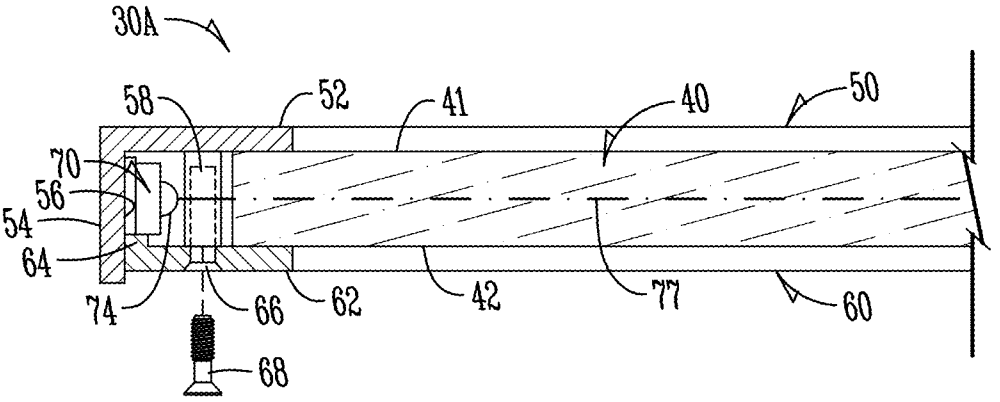


Fig. 5

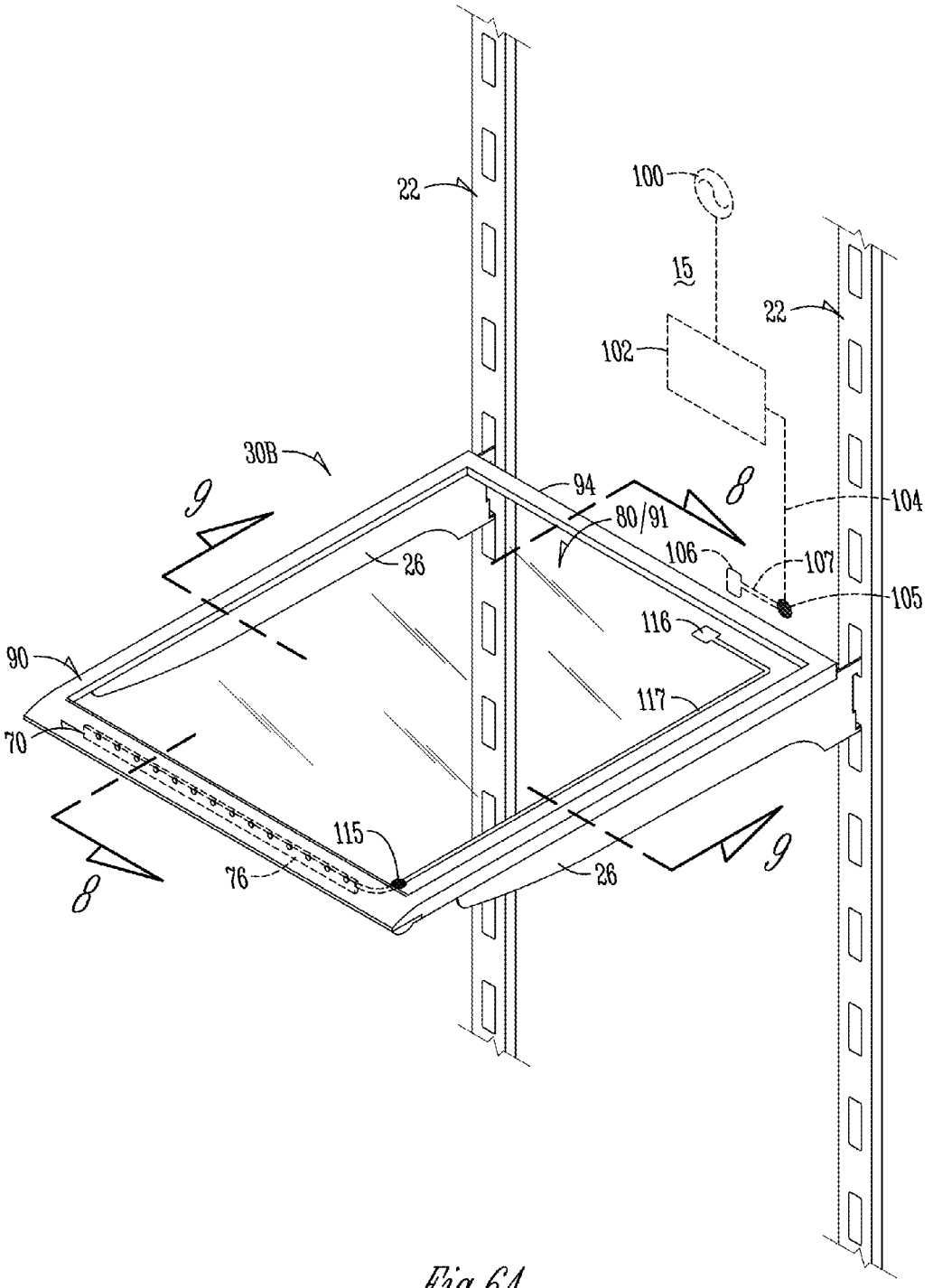

22
100
15
22
102
30B
9
94
8
80/91
104
26
106
107
105
116
90
117
70
115
8
76
26
9

Fig. 6A

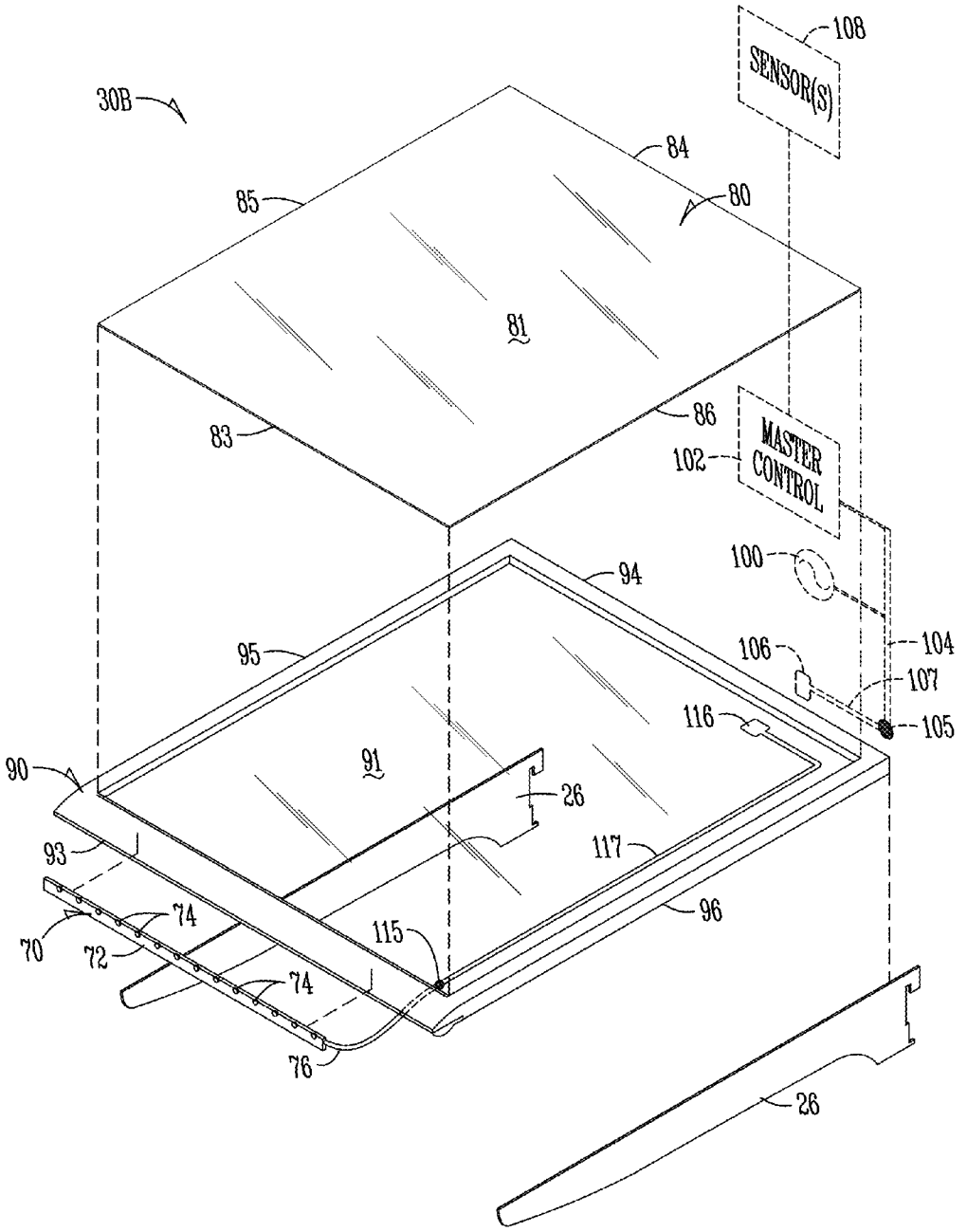

30B
108
SENSOR(S)
84
85
80
81
83
86
MASTER CONTROL
102
100
94
95
104
106
107
105
116
91
90
26
93
117
74
96
70
72
115
74
76
26

Fig. 6B

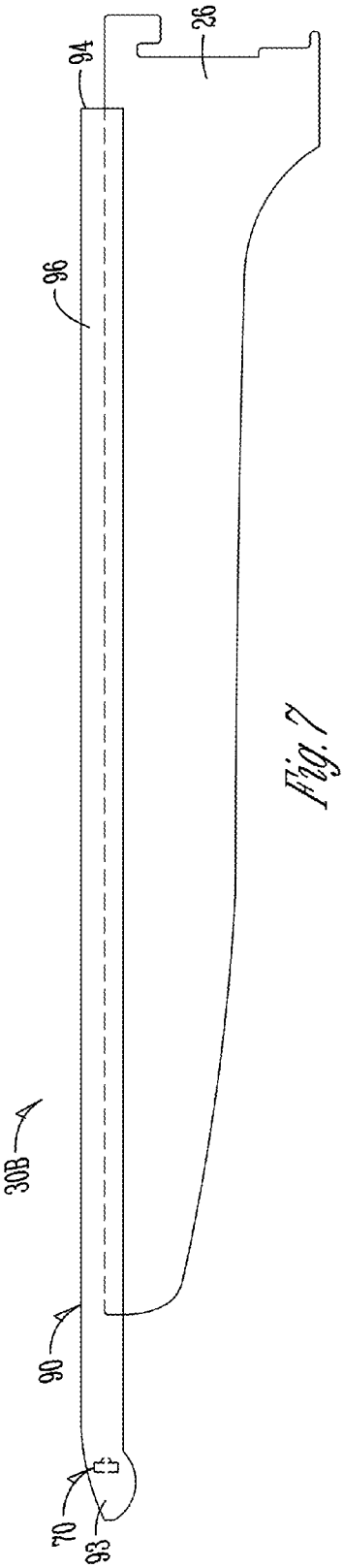


Fig. 7

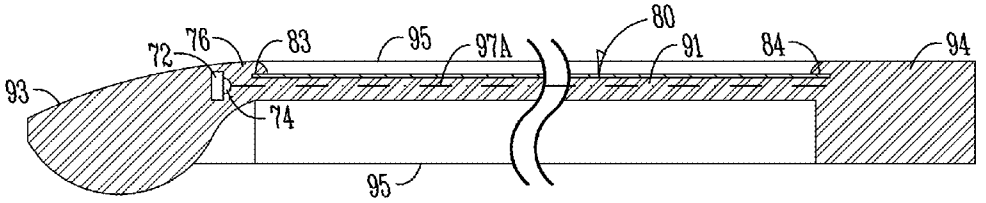


Fig. 8A

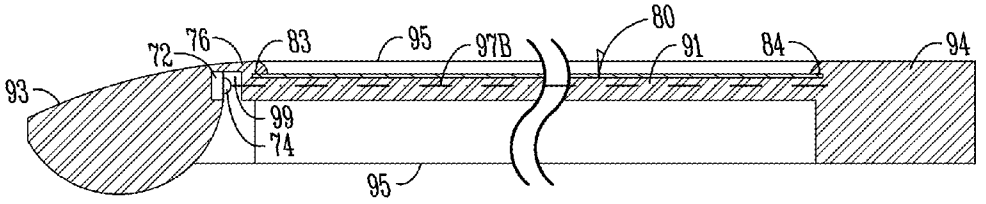


Fig. 8B

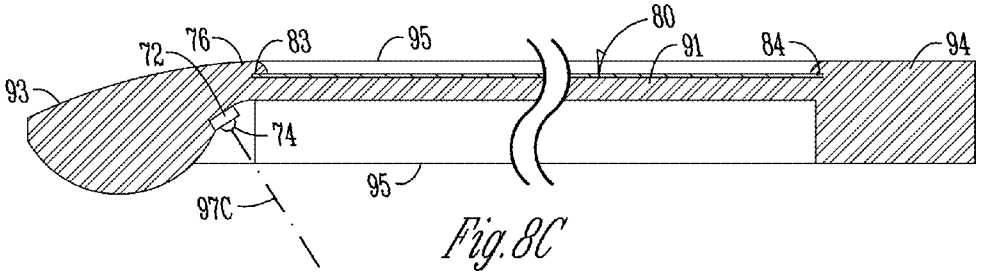


Fig. 8C

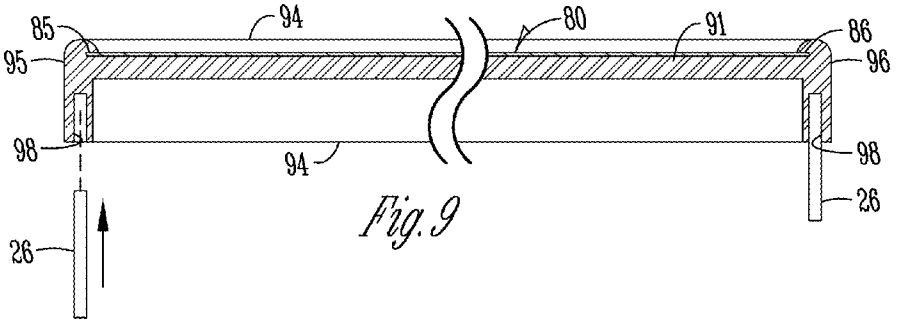


Fig. 9

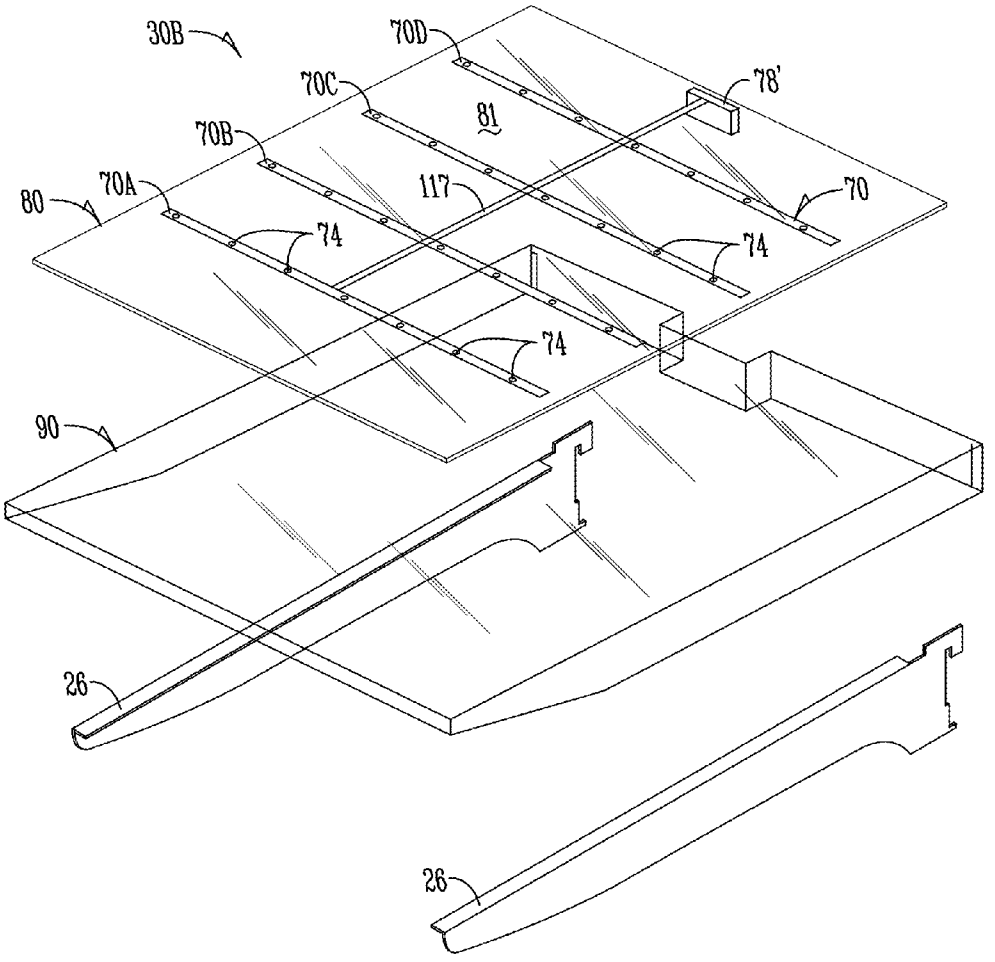


Fig. 10A

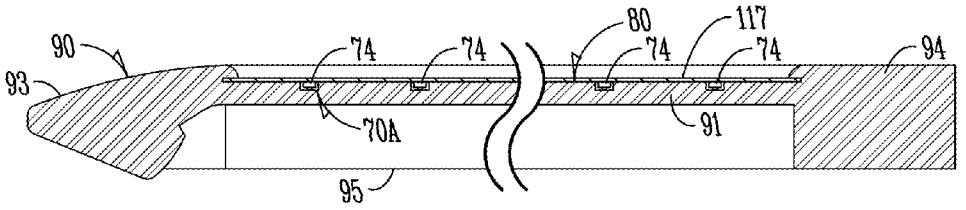


Fig. 10B

LIGHTED REFRIGERATOR SHELF WITH OVERMOLD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to refrigerators, freezers, refrigerator/freezers, other appliances, or other structures that have shelving, and in particular, lighting relative to that shelving.

[0003] 2. State of the Art

[0004] A variety of types of shelving exists. Some are for storage. Some are for display of objects. Some are exposed as with of book shelving without doors. Some are enclosed. An example would be inside a cabinet with closeable doors.

[0005] It can be desirable to provide lighting or illumination at or near shelving. However, there are many competing factors. Some are subtle. For example, the shelving material must be structurally robust enough to support what is intended to be stored there. This tends to require bigger, stronger, or thicker components. Another factor is space. Most times minimization of space occupied by the shelving components leaves more space for storage or display. Another factor can be presentation or access. In many cases, the ability to reach objects on the shelf is desirable. Sometimes visibility is important. Transparent shelves are sometimes used towards that end. Another factor is aesthetics. Form factor, proportion, and optical effects can enhance aesthetics and, sometimes, the functionality at the same time. A further aspect is flexibility of storage. It is many times desirable that the shelves be moveable. One example are outwardly slideable shelves. Another would be complete removal and placement at a different vertical height.

[0006] One particular example of shelving is adjustable shelves in refrigerators, freezers, or refrigerator freezers. A conventional shelf provides a storage surface for refrigerated food items. It can span part or all of a space inside the appliance cabinet. One conventional way to vertically adjust such shelves is along vertical rails or tracks that have different mounting elevations.

[0007] Some method of at least partial illumination is typical in the interiors of such appliances to help the user identify what is being stored. However, several factors regarding refrigerated appliances make design of such illumination much more than trivial. As stated, storage space is at a premium. Therefore, any source of illumination should take up as little storage space as possible. Conditions inside the cabinet are cold or even subfreezing (if in a freezer compartment). Thus, the illumination source must be able to work and last in that environment. Also, food items can be in liquid or semi-solid form and, therefore, protection of the lighting source and electrical connections from those substances is usually important. Also, it is not necessarily easy to route electrical power to such light sources.

[0008] Still further, cost is a factor with most appliances, particularly consumer appliances. Therefore, although the best illumination would utilize a number of light sources distributed throughout the cabinet, this is normally impractical from a cost perspective. Additionally, more light sources may translate into higher energy costs during operation.

[0009] Therefore, there are competing factors involved in illumination of the interior of such appliances.

[0010] One known configuration places an illumination source in or on the liner of the appliance. This can make it difficult to adequately illuminate all parts of the compartment involved.

[0011] Attempts at placing illumination sources inside the cabinet space includes mounting light sources on shelves. However sources like incandescent or fluorescent sources take up substantial room. They require relatively large sockets or electrical connections. Additionally, mounting on a shelf that is removable or horizontally adjustable raises issues of how to reliably supply electrical power to the lights.

[0012] A variety of attempts at shelf-mounted lighting have been made. Some utilize relatively smaller sources such as LEDs. Some utilize what could be called a power strip or power rail along the mounting bracket locations for adjustable shelves. A conductive contact on the shelf contacts the conductive vertical rail to supply electrical power.

[0013] However, many of these systems tend to be somewhat complex. Some involve a number of parts. And some are not perhaps as economical as might be desirable. The lighting sources tend to be readily identifiable by a viewer.

[0014] Therefore, there remains a need in the art for alternatives or improvements regarding interior lighting of such appliances. There is a need for improved visibility, aesthetics, and economy.

SUMMARY OF THE INVENTION

[0015] It is therefore a principle object, feature, aspect, or advantage of the present invention to improve over or solve problems and deficiencies in the art.

[0016] Further objects, features, aspects, and advantages of the invention relate to shelving that includes an illumination source which:

[0017] a. provides good visibility via illumination at or near the shelf but also good visibility to and through the shelf to even other parts of the surrounding structure or space;

[0018] b. provides an integrated system of shelf storage position and illumination including mounting and supplying electrical power to the illumination sources;

[0019] c. provides good aesthetics regarding shelving and/or areas around the shelving;

[0020] d. provides flexibility regarding manufacture, durability, economy;

[0021] e. provides good flexibility regarding type and effects of illumination;

[0022] f. provides good utilization of useable space;

[0023] g. promotes good efficacy of illumination;

[0024] h. promotes ability for economical use of electrical energy;

[0025] i. allows for beneficial use with a variety of shelving structures and storage cabinets or appliances with a variety of different internal storage components; and/or

[0026] j. can be applied to different structures, including enclosable spaces or open shelving.

[0027] One aspect of the invention is a shelf having a transparent or at least partially light transmissive storage surface, a perimeter frame, and a lighting subassembly, wherein the frame includes forms or receivers for complimentary receipt or integration of mounting brackets. The lighting subassembly is at or along at least one edge of the supporting surface or arrayed on the surface. The frame and supporting surface are

relatively thin. Electrical power to the lighting subassembly allows the lighting assembly to provide illumination through, at, or around the shelving.

[0028] Another aspect of the invention includes a refrigerator shelf having a top glass storage surface, a perimeter frame, and a lighting subassembly. The frame includes forms or receivers for complementary receipt or integration of mounting brackets. Electrical power to the lighting subassembly can be by wireless transfer or contact transfer to a source of electrical power available in the cabinet of the appliance. The framing of the glass supporting surface can include metal, plastic, or other materials that form framing components that are relatively thin to present a relatively similar thickness for the entire shelf for optimal utilization of space and aesthetics, but also carry a lighting subassembly and protect and hide the side edges of the supporting surface. The lighting subsystem can have light output that essentially distributes light through or along the glass supporting surface. It provides the look of a glass shelf essentially suspended in space but provides illumination at or near the supporting surface for the customer to identify the contents of the shelf. Alternatively, the framing of the glass supporting surface can be overmolded plastic.

[0029] In another aspect of the invention, the upper glass surface can have a relatively thin glass plate to which is overmolded an undersupport at least partially light transmissive plate of essentially the same perimeter size as the thin glass plate and one or more overmolded framing edges that protect edges of the thin glass plate. A lighting subassembly can be mounted to or overmolded into one of the molded frame edges or on the surface. The overmolding frame edges can include forms or receivers for complementary receipt of mounting brackets for the shelf. Electrical power can be through wireless transfer from a source of electrical power in the cabinet.

[0030] In another aspect of the invention a transparent or at least partially light transmissive supporting plate can be framed by overmolded plastic that includes one or more light sources or a lighting subassembly. A power connection is applied or mounted along the plate or framing and adapted for operative connection to a source of electrical power to operate the light source(s). The components are integrated in function and appearance.

[0031] These and other objects, features, aspects, and advantages of the invention will become more apparent with reference to the accompanying specification and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] FIG. **1** is a perspective view of a cabinet in which are supported one or more shelves that are adjustable vertically. In this particular example, the cabinet is a refrigerator/freezer fresh food compartment. The shelves are one example of one form the invention can take.

[0033] FIG. **2**A is an enlarged perspective view of the shelves of FIG. **1** from a bottom and left view point.

[0034] FIGS. **2**B and **2**C are black/white and color photographs respectively of the shelves of FIG. **2**A illustrating how a lighting subassembly on and optical pattern applied to each shelf provides at least the appearance of luminance from each shelf, and aesthetic and functional benefits.

[0035] FIG. **3**A is a still further enlarged perspective view of a single shelf from FIG. **2**A from a top and center perspective.

[0036] FIGS. **3**B and **3**C are black/white and color photographs respectively of the shelf of FIG. **3**A illustrating how the lighting subassembly and applied optical pattern provides at least the appearance of luminance from each shelf, and aesthetic and functional benefits.

[0037] FIG. **4** is an exploded view of the components of the shelf of FIG. **3**B.

[0038] FIG. **5** is an enlarged partial sectional view of the assembled front end of the shelf of FIG. **3**A taken along line **5-5** of FIG. **3**A.

[0039] FIG. **6**A is an assembled perspective view of an alternative embodiment of a shelf according to the present invention, in particular, a quite thin top glass plate to which is overmolded an undersupport plate/protective edge framing giving the appearance and properties of glass on the top side of the shelf but using plastic to support the thin glass layer and protect its edges. A lighting subassembly is overmolded into or mounted to the framing.

[0040] FIG. **6**B is an exploded view of the embodiment of FIG. **6**A with diagrammatic depictions of power and control components for the lighting subassembly carried on the shelf.

[0041] FIG. **7** is an enlarged side elevation view of FIG. **6**A.

[0042] FIG. **8**A is a sectional view of one possible form of the assembled shelf of FIG. **6**A taken along line **8-8** of FIG. **6**A, in particular, the lighting subassembly is overmolded and encapsulated in a front frame portion.

[0043] FIG. **8**B is similar to FIG. **8**A but shows one possible alternative form of the assembled shelf of FIG. **6**A taken along line **8-8** of FIG. **6**A, in particular, the lighting subassembly is separately mounted in a front frame portion but projects light substantially into the shelf assembly.

[0044] FIG. **8**C is similar to FIG. **8**B but shows the lighting subassembly projecting light angularly down and below the shelf.

[0045] FIG. **9** is a sectional view of the shelf of FIG. **6**A taken along line **9-9** of FIG. **6**A.

[0046] FIG. **10**A is an exploded view similar to FIG. **6**B but showing a slightly alternative embodiment wherein plural LED lighting subassemblies are mounted on the thin glass plate to which is overmolded framing **90**.

[0047] FIG. **10**B is a sectional view basically through the center of the assembled combination of FIG. **10**A in slightly enlarged fashion.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0048] The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application publication with color drawing(s) will be provided by the Office upon request and payment of the necessary fee.

Overview

[0049] For a better understanding of the invention, several exemplary embodiments will be described in detail below. It is to be understood that these are but a few examples of forms and configurations the invention can take and are neither inclusive nor exclusive.

[0050] The exemplary embodiments will be described in the context of a refrigerated appliance as illustrated in FIG. **1**. It is to be understood, however, that the illuminated shelves can be applied to refrigerators, freezers, or refrigerator/freezers of other configurations. Still further, the illuminated shelves could be applied to other appliances with enclosures

or adjustable shelving. Still further, any shelving for storage or display could utilize the principles of the invention.

[0051] The exemplary embodiments will also be described in the context of light sources that are LEDs. It is to be understood, however, that other lighting sources are possible.

Exemplary Embodiment 1

[0052] With reference to FIGS. **1-5**, a first exemplary embodiment of the invention comprises plural shelves **30** that can be mounted along vertical mounting rails **22** in fresh food compartment **16** of a refrigerator/freezer appliance **10**. One example one such an appliance is shown in FIG. **1**. Multiple shelves **30** could be mounted at different vertical heights and in different positions in fresh food compartment **16**.

[0053] FIG. **1** illustrates a French door/bottom freezer type refrigerator **10** having a cabinet **12**. The fresh food compartment is defined by a liner **15** such as are well known in the art. Doors **14**L and **14**R (left and right) open and close off compartment **16**. Freezer compartment **18** can be a slide-out drawer.

[0054] Vertical rails **22** include slots or mounting apertures **24** along their lengths. Shelf mounting brackets **26** have rear ends with hooked fingers that are complementary to slots **24** to allow such brackets to be placed at various vertical heights inside compartment **16**. A pair of brackets **22** supports each shelf **30** and allows selection of vertical elevation or mounting height in compartment **16**.

[0055] As is conventional in many such present appliances, a master control board or programmable microprocessor **102** is built in to cabinet **12** and can control a number of features and functions of the appliance. One examples is control of cooling. Another is adjustment of settings (e.g. temperature or features), some of which are user selectable. An electrical power source **100** (connected to commercial electrical power) can also be available in cabinet **12**. A wiring harness or bus **104** is typical to route electrical hardwire connections to various parts or locations in cabinet **12**.

[0056] FIGS. **2**A-C illustrate one style of shelf (ref. no. **30**A) that can be used in appliance **10** of FIG. **1** from a bottom perspective (this particular embodiment of shelf **30** is referred to by reference number **30**A). They show how brackets **26** support each shelf on vertical rails **22**. They also show the relatively thin profile of each shelf as it extends out into the space of the fresh food compartment. FIGS. **2**B-C furthermore show that each shelf **30**A appears to be luminous or has illumination associated with it. As can be appreciated from FIGS. **2**B-C, in this configuration each shelf has a substantially transparent main supporting area and the illumination associated with it gives the appearance of the supporting surface being luminous. Such a lighting scheme presents plural shelves, each appearing to be lit up individually. This presents an aesthetic overall appearance of the shelves hovering or extended in the compartment space with illuminated horizontal supporting surfaces. However the illumination is also functional. It assists a user to see the location of each lighted shelf and items supported on each shelf. Some of the light from a lighting subassembly in each shelf also may/can illuminate other parts of surfaces of the compartment or near the compartment. For example, a soft illumination of portions of liner **15** can be seen in FIGS. **2**B-C. Localized lighting at each shelf can save energy (compared to generalized cabinet illumination).

[0057] As can also be seen by reference to these figures, each shelf has the appearance of a glass shelf. Most of the area of each shelf is transparent or substantially light transmissive. A thin and relatively small surrounding frame work essentially encapsulates and protects the perimeter edge of each shelf. The thickness of the framing is not substantially greater than that of the glass plate. It can be thicker, but not many times the thickness such that it promotes the appearance of an integrated shelf (both framing and supporting plate) that is relatively consistent in thickness. However, that relatively small framework takes up little space and presents a clean, aesthetically-pleasing look for each shelf. The brackets that support each shelf are relatively thin and small. The shelves basically appear to be suspended in fresh food compartment **16**. Additionally, their white transmissivity allows a view through most of their area for increased visibility of other parts of compartment **16**.

[0058] FIGS. **3**A-C show another optional feature possible with shelf **30**A. Either its top surface **31** or its opposite bottom surface **32** (FIG. **2**A) can include a layer, coating, application or printing in some form that still allows the shelf to be substantially light transmissive but also still allows a view through and optically affects light that tries to pass through that central supporting surface. Reference numbers **33**, **34**, **35**, and **36** refer generally to the front, back, left side, and right sides of overall shelf **30**A. In this example, that addition is a moiré pattern or otherwise a pattern that can diffuse some of the light that passes through the light transmissive portion of shelf **30**A or at least present an interesting visual appearance. One example is a printed or applied brand name or logo. This could include words, numbers, graphic designs, or combinations. Here the moiré pattern is a mesh-like pattern, which has a configuration that appears to be roughly parallel dark and light bands. Other patterns can be applied to produce different appearance and optical effects in combination with illumination emanating from or at the shelf. It could be printed, silk-screened, etched or otherwise applied.

[0059] As further indicated in FIGS. **4** and **5**, shelf **30**A includes a light subassembly **70**. Assembly **70** comprises a printed circuit board (PCB) or mounting board **72**. On one side is operatively mounted a linear array of LEDs **74**. A light assembly wiring harness or bus **76** provides hardwire electrical communication between each LED **74** on board **72** and a termination. In this exemplary embodiment, the distal termination end of harness **76** includes an electrical contact or connection **78**. This allows power and information to be electrically communicated to and from LEDs **74**.

[0060] Further features of shelf **30**A are as follows. The supporting surface of each shelf **30**A comprises a glass plate **40**. Glass plate **40** has top, bottom, front, back, left side, and right side edges **41**, **42** (FIGS. **5**), **43**, **44**, **45**, and **46** respectively. It can be tempered glass on the order 2-3 mm thick and 375 mm×450 mm in width and depth. Of course other shapes and sizes and even configurations are possible. Moiré or optical pattern **49** (FIG. **4**; see also FIGS. **2**B-C and **3**B-C) is on glass plate **40**. Pattern **49** can be a separate layer. It could be applied, printed, embossed, or otherwise placed on either side (or both sides) of glass plate **40**.

[0061] A top frame section **50** comprises a top horizontal flange **52** and a vertical outer flange **54**. Vertical flange **54** would essentially fit over and protect the perimeter edges of glass plate **40** when placed on top of glass plate **40**.

[0062] A lower frame section **60** has a horizontal and vertical flanges **62** and **64** which are complementary to and fit within vertical flange **54** of top frame section **50** (see FIG. **5**). As indicated in FIGS. **4** and **5**, top and bottom frame sections

50 and **60** would basically mate and sandwich glass plate **40** between them. The frame halves **50**, **60** would be connectable by screws **68** or other fastening means through apertures in bottom frame **60** into tapped receivers **58** extending from the bottom of top frame **50** to basically encapsulate the edges of glass plate **40** and hold it in position. Frames **50** and **60** could be made of metal. Other materials are possible. The tolerances could be such that they closely match to the perimeter of glass plate **40** and to each other to not add much to the thickness to the glass plate **40** itself to provide that integrated look as shown in FIGS. **1**, **2**A-C, and **3**A-C. There could be cushioning or gasket material on one or more of frames halves **50**, **60** to cushion and further protect the edges of glass plate **40**.

[0063] LED lighting assembly **70** can be mounted as illustrated in FIG. **5** in a space between frames **50**, **60** along the inside surface **56** of vertical wall **54** of top frame **50** in alignment with the front edge **43** of glass plate **40**. The optical axis **77** of each LED **74** can be directed into front edge **43** and in the plane through glass plate **40** indicated at reference number **77** in FIG. **5** of glass plate **40**. Glass plate **40** would basically function as a light pipe or guide. This would tend to direct or guide light energy from LEDs **74** through the interior of the entire area of plate **40**. This would provide illumination at or through and/or at least the appearance of luminance from both sides of plate **40**. This would help identify objects on shelf **30**A but also provide some level luminance or illumination around shelf **30**A. It also provides the appearance of luminance or glow in glass plate **40**.

[0064] LEDs **74** could simply turn on and off upon some instruction. The instruction could simply be closing an electrical circuit from electrical power with a manually operated on/off switch. It could be from closing an electrical circuit directly from a switch that senses when one of refrigerator doors **14**L or **14**R is opened or closed. It could be by an activation signal from master control **102**. The activation signal could be from any of a number of triggers.

[0065] LED board **72** itself could include circuitry to have certain controllable functions for LEDs **74**. For example, on-board circuitry could include hardware components that would respond to and actuate certain operation of LEDs **74**. An example would be an LED driver circuit that could vary the intensity of any or all LEDs **74** according to instruction. The on-board circuitry could even include another processor or controller (it also could be programmable). An example would be a program that could flash or individually actuate any LED **74** according to different possible sequences, intensities, colors, etc.

[0066] Further examples would be the ability to alter the power in voltage, current, or duty cycle to any LED **74** for various lighting effects. There could also be different colored LEDs or types that could be collectively operated or individually operated.

[0067] LEDs can have different light distribution output patterns. For example, some are relatively wide beams and some are relatively narrow beam. Selection of the LEDs and their output patterns, along with the direction of their optical axes **77**, allows the designer to create different lighting effects with lighting subassembly **70**. For example, the optical axes could be substantially directed through the interior of glass plate **40** by substantially total internal reflection. Glass plate **40** would basically act as a light pipe or guide, guiding at least a substantial amount of the light output of LEDs **74** from glass plate front edge **43** to back edge **44**. Alternatively, the distribution pattern could be such that some light from LEDs **74** moves through and across interior of plate **40** but some light refracts out to provide light energy outside of the plane of plate **40**.

[0068] Another option would be to direct the optical axes of LEDs **74** other than into an edge of glass plate **40**. It could be generally parallel along the top or bottom surface of glass plate **54**. It could be angularly away from the plane of glass plate **40**. Different LEDs **74** could be directed in different directions.

[0069] Examples of edge-lit shelving are described at U.S. Pat. Nos. 6,210,013 and 8,322,873, which are incorporated by reference. Another example of LED shelf lighting is described at U.S. Pat. No. 7,338,180 which is incorporated by reference herein. Details about directing light into an edge of a light transmissive plate are set forth.

[0070] As indicated in FIG. **5**, board **72** could be mounted to frame section **50** or **60** by any number of techniques including but not limited to screws, bolts, adhesives, interference fit, or the like. One example is shown in FIG. **4** (screws **75** through tabs **73** into tapped receivers in frame **50**); another is in FIG. **5** (board **72** adhered or mounted along inside surface **56** of vertical flange **56** of frame **50**). Other mounting techniques are possible. It can be desirable that any fasteners not extend outside the outer surfaces of frame sections **50** and **60**.

[0071] As can be further understood, patterns such as the moiré pattern or other optical patterns could be selected according to desire or need. Typical techniques may be etched into the glass or ink applied to the glass surface. They could be utilized with a selection of LEDs **74** and their output distribution patterns for a variety of different lighting and optical effects.

[0072] FIG. **4** also shows mounting brackets for the shelf assembly. Brackets **26** could be solid or wire. They could be separate from shelf **30**A or unitary or integral to shelf **30**A. If separate (as shown in FIG. **4**), they could basically have a top edge or flange that would complementarily work with frame sections **50**, **60** and glass plate **40** in assembled form to support that assembly would sit and hold against at least lateral movement and downward movement. There could also be cooperating structure to allow the shelves to be slid forward or removed. Examples of such features are known in the art.

[0073] It could therefore be seen that shelves **30**A of FIGS. **1-5** are an integrated assembly that includes a glass supporting surface. Such a surface has good aesthetic appeal, is easily cleanable, and is considered by most customers to be hygienic. Glass also has inherent optical properties that can attribute to the aesthetic appearance both when LEDs **74** are on or not. Furthermore, the frame halves **50**, **60** provide a metal edge protection of glass **40** but do so on a size scale that is similar to the thickness of glass plate **40**. They do not add much additional thickness to glass plate **40**. Thus, a pleasing overall appearance of dimensions and size proportions is presented. This includes the supporting glass surface and the edge protection of frame sections **50** and **60**. In addition, built-in integrated light subassembly **70** allows illumination and luminance at and around shelf **30**A to provide additional aesthetics. Still further, brackets **26** can be formed to be complementary to and retain the appearance of a glass supporting surface floating in a fresh food compartment. In addition, the embodiment promotes good visibility or optical

clarity of not only items supported on shelf **30**A but on other adjacent shelves and, if appropriately configured, throughout the fresh food compartment.

[0074] The embodiment also promotes economy by allowing a relatively few number of pieces to be assembled in an integrated fashion for a shelf that could be fixed into place or removable, and optionally adjustable vertically or horizontally. This includes carrying with it an illumination source (e.g. lighting subassembly **70** with LEDs **74**).

[0075] Electrical power to lighting subassembly **70** can be supplied as follows. Electrical power for shelf **30**A could be available by simply running hardwire harness (one or more individual wires) **76** from board **72** along shelf **30**A, or internally between a side edge of glass plate **40** and its corresponding frame, to at the rear edge of shelf **30**A. As is well-known in the art, a conductive rail or channel **28** (FIG. **3**A) can be formed along one of the pair of vertical shelf mounting rails **22**. Contact **78** at the distal end of wire harness **76** could be mounted to extend from the rear edge of shelf **30**A so that it would come into abutting contact with a conductive portion of power rail **28** when shelf **30**A is in appropriate position in compartment **16**. An example of such a power strip is disclosed at U.S. Pat. No. 6,813,896 (commonly owned by the owner of the present invention) and incorporated by reference herein. This combination of a hardwired harness from LEDs **74** with an electrically conductive termination **78**, and a vertical power strip of conductive material along the shelf mounting rails **22**, allows a shelf **30**A to be placed in any vertical position along rails **22** and receive electrical power for LEDs **74**. This eliminates the need for long wires or electrical plugs. However, those are other options to supply power to LEDs **74**.

[0076] As can be seen by the foregoing and FIGS. **1-5**, shelf **30**A is an example of an integrated shelf and lighting system which addresses one or more of the objects of the invention. Its functions and appearance are illustrated in FIGS. **1-5**, including the photographs of FIGS. **2**A-C and **3**A-C, which show the lighting system of each shelf **30**A turned on.

Exemplary Embodiment 2

[0077] By referring to FIGS. **6**A-B to **9**, another exemplary embodiment according to the invention is shown. This shelf **30**B has similarities to shelf **30**A of FIGS. **1-5**. By referring to FIG. **6**A, shelf **30**B integrates an at least partially light transmissive main supporting surface with edge framing and protection with a lighting subassembly. It builds into the framing receivers for shelf mounting brackets. It provides communication of electrical power to the lighting subassembly. Some notable differences are as follows.

[0078] In this embodiment, a thinner glass plate **80** than glass plate **40** is utilized to present a glass top supporting surface **81** for shelf **30**B (see FIG. **6**B). One example would be a tempered glass sheet of on the order of one millimeter thick. Overmolded to it is framing **90**. Framing **90** includes an at least partially light transmissive planar supporting surface or undersupport **91** (on the same order of perimeter size as thin glass plate **80** but thicker), and front, back, left, and right side edge frame portions **93**, **94**, **95**, and **96** that basically encapsulate front, rear, left and right edges of **83**, **84**, **85** and **86** of thin glass plate **80**. FIGS. **8**A and **9** show that encapsulation. Lighting subassembly **70** is either overmolded in frame **90** adjacent to at least one edge of glass plate **40** or supporting surface **91**. As can be seen from FIG. **6**A, the overall assembly **30**B (like assembly **30**A) presents a substantially light transmissive glass appearance supporting surface with a relatively thin framing **90**, relatively unobtrusive mounting brackets **26** that fit into molded forms or receivers in frame **90** (and do not require separate or additional pieces in frame **90**), and a lighting system. The entire assembly **30**B gives an integrated, thin, open appearance, but includes a lighting subassembly, edge protection, mounting interfaces, and electrical power connection to power the lighting subassembly, even though shelf **30**B can be removed and repositioned elsewhere along a mounting subsystem (here vertical rails **22**, but it can take other forms).

[0079] Overmolding is well-known in the appliance industry. Overmolding involves injection molding of one material, usually a thermoplastic (here frame **90**) onto a second material (here thin glass surface **80**). If properly selected, the overmolding thermoplastic will form at least some bond with the second material that is maintained in the end use environment. One example of overmolding is called insert molding. Single shot or multiple shot injection molding machines can be used. Sometimes there can be multiple materials shot into the same mold during the same molding cycle. Some of the factors and design characteristics of overmolding are set forth in publication entitled "Overmolding Guide" at http://www.glstpes.com/pdf/literature/Overmold%20Design%20Guide.pdf, by GLS Thermoplastic Elastomers and incorporated by reference herein. Examples of overmolding is described at U.S. Pat. No. 7,748,806 (commonly owned with the owner of the present application), incorporated by reference herein. Another example of overmolding, and in particular related to refrigerator shelving can be found at U.S. 2009/0195136 commonly owned and incorporated by reference herein.

[0080] In this embodiment, the overmolded thermoplastic of at least undersupporting surface **91** is a resin material having light pipe or light guiding properties. An example of utilizing thermoplastic molded material as a light pipe or guide can be found at U.S. 2011/0085287, owned by Whirlpool Corp., and incorporated by reference herein. Additional discussion of light guide or pipe materials can be found at "Light Guide Techniques Using LED Lamps", application brief I-003, by Avago technologies available at http://www.avagotech.com/docs/5988-7057EN and incorporated by reference herein. It is possible that frame **90** could also have light guide or light pipe characteristics.

[0081] In this example, the overmolded resin material is polycarbonate (Lexan®) with 85-91% transmission. Cost, mechanical performance, moldability, light path design and transmission desired will affect the resin material selected and can be considered by the designer.

[0082] FIG. **6**B shows diagrammatically and in isolation overmold frame **90**, with its light transmissive undersupport **91** and side framing portions **93**, **94**, **95**, and **96**, and thin glass plate **80** exploded above it. Overmolding would begin with glass plate **80** placed into the mold. Flowable plastic material would then be injected into the mold and flow under and around the edges of glass plate **80**. It would cool and harden to support the underside of glass plate **80** and encapsulate and protect the edges of glass plate **80** as illustrated in FIGS. **8**A and **9**. It would have the integrated appearance of FIG. **6**A.

[0083] As further illustrated in FIGS. **6**A-B, **7**, **8**A-C, and **9**, in this exemplary embodiment the overmolding provides not only an underlying support surface **91** for thin glass plate **80** across its entire area but also essentially encapsulates all four of its edges to protect those potentially fragile edges. The combination therefore presents an actual glass top supporting

surface **81**, with its desirable features, but utilizes only a very thin glass plate or sheet **80**. The overmolded undersupport surface **91** is also light transmissive; basically transparent or optically clear or substantially so, if desired. The overmolding process can be controlled to essentially mold that undersupport **91** to the bottom of thin glass plate **80** such that there are essentially no gaps or air bubbles between the two. This promotes the appearance of a single supporting surface even though it is two layers; one made from glass plate **80** and the other undersupporting plastic layer **91**. The resin and overmolding process can also be controlled so that undersupporting layer **91** can have at least similar optical properties (e.g. transparency) to glass layer **80** to promote the appearance of a single layer. But it does not have to have the same optical properties. Either glass plate **80** or underlayer **91** can also be modified to have other optical properties. One example is adding a moiré pattern, logos, informational text or other optically altering aesthetic enhancing effects.

[0084] As also indicated in FIG. **7**, overmolded frame **90** could be molded to have receivers (see slots **98** in FIG. **9**) for shelf mounting brackets **26**. Receiver **98** could be a recess or form molded into each opposite side frame portions **95** and **96** into which the top edge of a shelf mounting bracket **26** would complementarily fit and prevent movement of shelf **30**B at least downwardly and laterally. If appropriately formed, slots **98** could also prevent fore and aft movement relative to cabinet **12**.

[0085] As further illustrated in FIGS. **6-9**, shelf **30**B can include a lighting subassembly **70** similar to that of the first embodiment. In this example, a linear array of LEDs **74** on a PCB **72** is positioned along front edge **93** of overmolded frame **90**. It is to be understood, however, that additional arrays could also be positioned along one or more other edges. They could be linear or other configurations.

[0086] FIGS. **8**A-C illustrate several optional LED mountings. FIG. **8**A shows the whole lighting subassembly **70** (PCB **72**, LEDs **74**, and wire harness **76**) could be overmolded into frame **90**. Those components would be placed into the plastic mold with glass sheet **80** and basically encapsulated into place. Because at least undersupport **91** of frame **90** is light transmissive, the light output of LEDs **74** (if their optical axes along plane **97**A are directed along the plane of undersupport **91**) would be guided along undersupport **91** and provide the luminance/illumination along the whole area of undersupport **91**. The light transmissivity of glass plate **80** would allow persons to see that luminance/illumination. It would glow like a shelf **30**A of FIGS. **2**A and **3**A. PCB **72** could also be mounted so that optical axes **97**A would extend parallel but underneath undersupport layer **91** so that the beams from LEDs **74** would project along the bottom of shelf **30**B.

[0087] Alternatively, as shown in FIG. **8**B, overmolded frame **90** could have a recess **99** under its front edge **93** to which a linear array of LEDs **74** could be mounted. The optical axes of LEDs **74** could be positioned to direct light from LEDs **74** into a front edge of undersupport **91** and/or the front edge **83** of glass plate **80** such that light could be directed through one or both of those layers along plane **97**B.

[0088] Another option is shown at FIG. **8**C. LED board **72** could be angled slightly downward such that the optical axes of one or more of LEDs **74** is angled downwardly from the front edge **93** of shelf **30**B along plane **97**C (or at different angels). All or part of the light distribution from LEDs **74** could then provide illumination downward. The beams from LEDs **74** would project downward and illuminate the space and any structure(s) below shelf **30**B. Still further, board **72** and LED **74** could be configured both to provide edge lighting for either glass surface **80** or undersupport **91** and light distribution in one or more other directions.

[0089] As illustrated diagrammatically in FIGS. **6**A and **6**B, an alternative way of providing electrical power to LEDs **74** is through inductive, capacitive or magnetic transfer. This is sometimes called touchless or wireless electrical transfer. A receiving antenna **116** on shelf **30**B can have a terminal end in operative proximity of radiating antenna **106** behind liner **15**. Antenna **116** can be any of a variety of forms. One example is a thin foil or layer metal or other electrically conducting material mounted flush to the top or bottom surface of either undersupport **91** or thin glass plate **80**. The mounting can be by adhesive, thin layer deposition, printing or otherwise. A similar thin foil or layer trace **117** is in electrical communication with hard wire harness **76** to each LED **74** on board **72** at solder point (or other electrical connection point) **115**. This arrangement does not take up any storage space and is contained on shelf **30**B.

[0090] Radiating antenna **106** is electrically connected to electrical power source **100** in appliance **10** (e.g. via conducting section **107** to solder or connection **105** and then wire harness **104**) and master control **102**. By methods known in the art, electrical power from power source **100** can be transferred wirelessly or touchlessly between antennas **106** and **116** in a manner that can be utilized to power LEDs **74**. An example of such touchless coupling is described in U.S. Pat. No. 7,293,422, commonly owned by the owner of the present invention and incorporated by reference herein.

[0091] In this method, by having at least one antenna **106** in sufficient proximity to all possible positions for shelf **30**B, electrical power would be available for different vertical or horizontal positions of shelf **30**B. Thus, LEDs **74** could be operated at any time including if shelf **30**B were slid outwardly or moved to a different elevation in cabinet **12**. Antenna **106** could be foamed-in-place when a refrigerator compartment is thermoformed.

[0092] An additional possible feature includes not only touchless or wireless transmission of electrical power from power source **100** to LEDs **74** but also transmission in either direction of data or information in electrical form. Such data or information transmission is also described in U.S. Pat. No. 7,293,422, which is incorporated by reference herein. A variety of commercial venders provide commercial products that allow such shared communication of both power and instructions or feedback. This will allow master controller **102** to provide any of a variety of operational instructions to operation of LEDs **74** or to other functions at circuit board **72** without having to be hardwired or have touch or contact through a conducting path.

[0093] One definition of contact or contactless power is transmission of electrical energy from a power source to an electrical load without man-made connectors. U.S. Pat. No. 7,293,422 describes inductive or capacitive power transfer and data exchange in both directions in the context of a refrigerator appliance. US 2012/0140440 and U.S. Pat. No. 7,522,878, incorporated by reference herein, describe contactless power and communication.

[0094] Resonant inductive coupling is one type of wireless or touchless electronic transmission method. Such power transfer is in use in a variety of commercially available products. At least the receiver structure **116**/**117** on shelf **30**B can be of a form factor that is thin layered. Thus, it could be

applied to shelving without occupying much space. It can also be relatively thin and not physically or visually disrupt the look of and any light transmission associated with the shelf. The transmitting part **106**/**107** could be behind the back or side wall of the supporting structure for the shelf. For example in the case of a refrigerator, it could be hardwired to electrical power in an appropriate transmitting components for wireless power and data transmission behind the refrigerator liner. It is generally better to have the two contactless components as close together as possible. Transmitting components **106** could be placed at various levels throughout the cabinet supporting shelves and be available for shelves of multiple different positions or multiple shelves.

[0095] Alternatively, electrical power to LEDs **74** on shelf **30**B could be by other techniques. For example, it could be by any of the techniques described with respect to embodiment **1**, including through a contact arrangement or hard wiring.

Options and Alternatives

[0096] As can be appreciated by those skilled in the art, the invention can take many forms and embodiments. Variations obvious to those skilled in the art will be included within the invention. Some specific examples are as follows.

[0097] The lighting subassembly **70** could be separately mounted (screws, bolts, adhesive, or other fastening techniques) to the overmolded portion **90** or metal frame portion **50** or **60** for shelves **30**B and **30**A respectively. Alternatively, they could be more integrated. An example would be to overmold to board **72** in an overmolded frame such as shown in FIG. **8**A. An alternative is illustrated at FIGS. **10**A and **10**B. Instead of positioning the lighting subassembly in the perimeter framing of the overmolding, one or more lighting subassemblies **70** (here for illustration **70**A-D; but there could be more or less or different configurations than linear raised) could be mounted at or on the glass plate **80**. For example, by deposition or printing processes known in the art, LED **74** and electrically conductive traces to them could be printed directly on the underside of thin glass plate **80**. Conductive trace **117** could also be printed to that surface and in electrical communication with some sort of power connection **78'** (it could be contact, contactless, or inductive/magnetic/capacitive connection to electrical power and/or information transfer). That combination (thin glass plate **80** plus the LED lighting assemblies) printed on plate **80** and the electrical traces to power connection (can be low voltage) can then be placed in an insert mold and the overmolded framing and undersupport **90** overmolded to that combination. Of course, the lighting subassemblies could also be positioned in the mold so that they would end up inside the overmolded undersupport of overmold framing **90** and electrical connections made to the power connection. Such lighting assemblies could also be used in conjunction with those around the perimeter of framing **90**. FIG. **10**A shows lighting subassembly **70**A-D printed on the underside of thin glass plate **80** prior to being overmolded with framing **90** separated for illustration purposes only.

[0098] FIG. **10**B shows the cross-section of the glass plate **80** with printed lighting subassemblies and the overmolded framing, including the undersupport **91**. This provides light sources all along the optically clear portion of the assembled shelf. It retains its thin and glass appearance but has lighting available across that area.

[0099] The types, characteristics, and configuration of the light sources can vary. For example, it does not have to be necessarily a linear array, although such does work well with keeping the overall appearance of either shelf assembly thin. The spacing, number, and arrangement can vary. As indicated in FIGS. **8**A-C, for example, some part of the overmolding could extend outwardly from glass surface **80** and could be shaped or configured to receive any number of light sources or configurations. As previously mentioned, a pattern on the shelf surface could be some sort of pattern that optically alters light that issues from the shelf surface. One example is a moiré pattern. Other diffusion patterns are known in the art. As it is further well known in the art, facets or forms can be made in other patterns in the shelf supporting surface if plastic. Some patterns can be printed to glass. It is to be understood that any number of single or multiple patterns are possible at any surface or along any part of the shelf. Some of the patterns can optically alter the light distribution. Some could be informational or even aesthetic. An example would be printing a logo. The printing or embossment or engravement or other patterning could actually have both visual and light affecting functions. Still further, arrangement of the LEDs and/or such optical enhancements can provide different visual effects. This is akin or analogous to use of LED lighting arrays in certain configurations alone or with lens or optical patterns to create brand identity with automobile taillights or headlights. For example, one or more shelves of each brand of appliance could have a consistent LED array configuration and/or optical pattern so that when a consumer views the shelf there could be identification with a brand or a sub-brand of a certain company. Optical patterns could be molded into plastic. They could be silk screened or printed on plastic or glass. There could be a combination of patterns with the embodiment **30**B—one printed or silk screen on the thin glass **80**, another molded into the undersupport plastic part of the framing.

[0100] Still further, light sources could be distributed along other edges of the shelf assembly. While the exemplary embodiment shows them along just the front edge, they could be at any other side or edge. They could be at two edges, three or all four.

[0101] And, as mentioned, the type and characteristics of the light sources can be uniform or they could vary. For example, they could vary as to color, light output distribution, output intensity, or other characteristics. They could be individual controlled, controlled together. They could be controlled in subsets.

[0102] Furthermore, the materials related to the supporting surfaces or parts thereof could affect light guiding or optical manipulation of the light from the light sources. Reflective surfaces, lenses, light absorbing surfaces, or other optical components could be added at the light sources, or other locations on or near the shelves.

[0103] Circuit board **72** could include some intelligence such as microprocessor, circuitry, and memory that could help with or add to the variety of functions related to the light sources or other features.

[0104] Another possible feature would be to have some sort of sensor at or near the shelf or in some other location relative the appliance **10**. For example, as illustrated diagrammatically in FIG. **6**A, a sensor **108** could be mounted somewhere on or in appliance **10** and in electrical communication with master control **102**. It could be included on circuit board **72**. It could feed back information to master control board **102** via a wiring harness or bus, or contact or touchless transfer back to master control board **102**. An example of sensor **108** is a

switch. It could inform control **102** that a refrigerator door **14** has been opened. Control **102** could then communicate an instruction to turn on LEDs **74** of one or more shelves **30**. Another sensor example is a temperature sensor. It could inform master control board **102** of temperature at or near a shelf **30**. Master control **102** could instruct some sort of indication correlated to that temperature sensing by LEDs **74** of that shelf **30**. For example, if sensed temperature is above user set point for that shelf or compartment **16**, LEDs **74** could be flashed to alert the appliance user. Another example would use different colors. If LEDs of different color output were mounted on a PCB **72** for a shelf **30** (e.g. red, blue and white), control **102** could activate the red LEDs if temperature set point range is exceeded to indicate to the user the temperature is too high. Blue could be turned on (and red and white not turned on) to indicate temperature below a set point range. White LEDs could be operated if temperature is within set point range. Another example for sensor **108** would be a proximity or motion detector. It could detect proximity or motion indicative of the presence of a person, and controller **102** could turn on LEDs **74** for one or more shelves **30**. Once detector **108** ceases to detect such proximity or motion, controller **102** could turn LEDs **74** off. Such a detector could be placed at or near a specific shelf **30** and be calibrated to alert proximity or motion only if at or near that shelf. In this way a single shelf could be illuminated.

[0105] Alternatively, any number of lighting schemes could be presented to the user either randomly by master control **102** or according to user choices. For example, one scheme might be to turn LEDs **74** on at a highest intensity level when a refrigerator door **14** is first opened (e.g., to help the user see items supported on the shelf **30**). After a certain time period the intensity could drop or it could slowly ramp down. It could ramp down to a dimmer level or completely to turn off. Another example would be to run the LEDs at steady state when a shelf is back in a home position in compartment **16** but if the shelf can be selectively slid out, to flash or otherwise change output to make the user aware the shelf needs to be pushed back in before closing door **14**. Any of a number of a variety of lighting schemes is possible.

[0106] Still further, the overmolded version **30**B could have just the overmolded frame portions **93**, **94**, **95**, and **96** and not the undersupport **91**. Or it could just have the undersupport **91** somehow adhered to the thin glass surface **80**. Or combinations of undersupport in just one edge frame portion, two frame portions, three or four are possible. Alternatively, brackets **26** could be inserted in a mold and, in the example of shelf assembly **30**B, the overmolding **90** could be overmolded to the brackets. They would then be incorporated or integrated into the combination but not removable therefrom. Brackets could also be fixed to the other part of the shelf. For example, with embodiment **30**A, by adhesive, screws, or other techniques, brackets **26** could be fixed in place. This could be true similarly of embodiment **30**B. But in some examples, the overmolding or the framing could have forms in the perimeter framing that would receive complimentary shapes in brackets **26** to support the shelf on the brackets in a stable manner.

[0107] As with Exemplary Embodiment 1, left and right side frame portions **95** and **96** could be molded to have a slot that is complementary to mounting bracket **26** such that shelf **30**B can simply be set down onto a pair of brackets **26** and held in place against lateral, forward, or downward further movement.

[0108] Additionally, the antennas **106** and **116** possible for touchless power/data transfer can be thin film or applied to the top or bottom side of undersupport **91** or glass plate **80** and not take up any space. They could be applied on the outside or inside of the overmolded frame portions. Or they could be a separate piece. As has been mentioned, electrically conductive leads could be printed onto either a glass surface or plastic surface to decrease materials cost, maintain thinness and good clean appearance and the like.

[0109] As can be appreciated, in many structures, particularly appliances that have functions in addition to illumination, an intelligent control exists. In the example of a refrigerator appliance, many current such appliances have such an intelligent controller or master control. It can manage electrical power to other functional components (e.g. cooling subsystem, ice making subsystem, dispenser subsystem, user selectable interfaces, etc.). In the context of the exemplary embodiments, such a master control could be programmed or could take user input and translate that into lighting effects for the light subassemblies at each shelf. Examples of such a master control or intelligent control are described at U.S. Pat. No. 7,765,819, U.S. Pat. No. 7,891,198, and US 2009/0277210, all incorporated by reference herein. For example, the intelligent control could be programmed to activate lights at the shelf on any of a number of triggers or states relative the appliance. One example would be to turn the lights on for a shelf when an intelligent control senses the door in front of the shelf has been opened. Another example would be to automatically turn on the lights when the door is opened but turn them off if the shelf is moved (e.g. slid forward) a given distance. Another would be to keep the lights off at a shelf unless a touch sensor or other user activated switch is touched or a proximity sensor senses a user's hand within range of the sensor.

[0110] The ability of the master control or intelligent control to monitor different sensed conditions, states of the appliance, or user inputs, as well known. The incorporated by reference U.S. Pat. Nos. 7,768,189, 7,891,198, and US 2009/0277210 provide examples of different sensed conditions, states of the appliance, or user inputs that could be monitored and utilized in the effecting a lighting effect with the light subsystem at one or more shelves. Examples could include sensing temperature at or near the shelf and illuminating a certain color output of LED out of plural different colors on the shelf. An example would be if the shelf is intended for storing fresh food items and the temperature around it is within range of a default range or a user selectable range. The lights could be blue to indicate within range temperature. However, if the temperature sensors sense temperature above the range, red LEDs could be illuminated and the blue LEDs turned off. A third color such as white could indicate some other condition. Another example would be sensors on, at, or near a shelf **30** when it is in operative position in an appliance (see, e.g. FIG. **6**B). The sensor could feed back information to an appliance controller that could inform or influence a lighting affect at shelf **30**. An example would be a temperature sensor at or near the top supporting surface of shelf **30**. If temperature at that location in a refrigerated appliance exceeds some sort of set point, red LEDs could be turned on by the controller to indicate to the appliance user the temperature has gone above set point. If below set point, LEDs could be turned on to indicate normal condition but illuminate the shelf. On the other hand, if temperature goes below a set point, blue LEDs could be turned on.

[0111] Another example would relate perhaps more to a bin or drawer. Some bins or drawers can actually have heater elements. An example would be a thawing drawer. Frozen food could be placed in the thawing drawer and a temperature regiment applied to promote safe but quick thawing. LEDs in the drawer could be controlled by feedback from a temperature sensor sensing temperature in the drawer to inform the user that the food is not yet thawed (e.g., blue lights). Then when it is sensed that the food is thawed, red LEDs could be turned on. Another example could be a sensor that senses some characteristic of food to inform a lighting affect. An example would be a chemical sensor that could sense if food is spoiling or rotting. It could then feed that information to the controller which could turn on red LEDs or some other color to alert the user. Instead of color, flashing or other variable driving of the LEDs could be implemented. A designer could utilize any of a variety of feedback information and any of a variety of lighting effects. A benefit of that combination is that each shelf or drawer or bin has its own control and communication of information to the user. Each shelf or drawer or the like at least appears to be "smart" in this context.

[0112] Still further, an intelligent control could be programmed to provide different lighting effects from any lighting subassembly on a shelf. One example would be to flash if the user's hand comes in proximity to the shelf, if the shelf is slid forward and needs to be slid back to home position before door could be closed, or if temperature sensed around it is out of range. Another example would simply be to ramp up the intensity of the lights based on time or some other factor.

[0113] As can be appreciated, the driving of the LEDs based on some sensed condition or trigger could take any number of forms. The designer could select the same based on some desired indication to the user that conveys some information relative to the shelf, what is on the shelf, or the area around the shelf. It could also be for aesthetic purposes.

[0114] It is to be understood that the invention could take a wide variety of forms and configurations. Variations obvious to those skilled in the art will be included within the invention.

[0115] Different features of the different exemplary embodiments can be utilized in still further embodiments. For example, the two piece framing of exemplary embodiment one could be substituted by the overmolded framing of exemplary embodiment two. Or the two layer middle supporting plates of exemplary embodiment two could be a single plate of glass or plastic more robust than the thin top glass plate of embodiment two.

What is claimed is:

1. A shelf comprising:

a. an at least partially light transmissive supporting plate having a thickness and a perimeter edge;

b. a framing surrounding the perimeter edge of the supporting plate, the framing having a thickness not substantially greater than the thickness of the supporting plate and an outward extension not substantially greater than the perimeter edge;

c. a lighting subassembly along at least one portion of the framing or supporting plate, the lighting subassembly and comprising one or more light sources having light output directed through or along the supporting plate;

d. a connection to electrical power between the lighting subassembly and at or near the framing; and

e. shelf mounting brackets associated with the framing;

f. so that size and proportion of the supporting plate to the framing and lighting subassembly of the framing provide an integrated storage surface, local illumination, and thin appearance when supported by mounting brackets in a space.

2. The shelf of claim **1** wherein the supporting plate comprises glass.

3. The shelf of claim **1** wherein the supporting plate comprises plastic.

4. The shelf of claim **1** wherein the supporting plate comprises a thin top layer of glass and a thicker bottom layer of plastic.

5. The shelf of claim **4** wherein the top and bottom layers are at least substantially optically clear.

6. The shelf of claim **1** wherein the framing comprises a pair of frame members.

7. The shelf of claim **6** wherein at least one of the frame members comprises metal.

8. The shelf of claim **1** wherein the framing comprises overmolded plastic.

9. The shelf of claim **1** wherein the framing comprises plastic.

10. The shelf of claim **9** wherein a part of the plastic comprises a light pipe.

11. The shelf of claim **4** wherein the framing comprises overmolded plastic and the bottom layer of the supporting layer is a part of the overmolded plastic.

12. The shelf of claim **1** wherein the light output of the lighting subassembly is directed substantially through the supporting plate.

13. The shelf of claim **1** wherein the light sources comprises LEDs.

14. The shelf of claim **13** wherein the LEDs are arranged in one or more substantially linear arrays on or at least one of the framing or the supporting plate.

15. The shelf of claim **13** wherein at least two LEDs have different color outputs.

16. The shelf of claim **1** further comprising an optical component associated with the light output of the light sources.

17. The shelf of claim **16** wherein the optical component comprises a pattern on the supporting plate.

18. The shelf of claim **1** wherein the connection to electrical power comprises a conductor terminating in a conductive contact at or near the framing.

19. The shelf of claim **1** wherein the connection to electrical power comprises a contactless connection.

20. The shelf of claim **19** wherein the contactless connection comprises inductive, capacitive, or magnetic power transfer.

21. The shelf of claim **1** wherein the connection to electrical power is adapted to transfer electrical power and/or data and further comprising a sensor at or near a shelf which provides data to inform a lighting effect from the light sources at the shelf.

22. The shelf of claim **1** in combination with a supporting structure adapted to receive supporting brackets to suspend the shelf in space.

23. The combination of claim **22** wherein the supporting structure comprises a refrigeration appliance cabinet.

24. A refrigerator shelf comprising:

a. a glass plate providing an upper shelf surface and having a perimeter edge;

b. an overmolded plastic framing having a perimeter on the same order of size as the perimeter edge of the glass plate, the overmolded framing comprising an undersupport for the glass plate;
c. a mounting location for a light source on at least one of the glass plate and the framing;
d. an electrical power connection to the mounting location for the light source;
e. so that the shelf is an integration of the glass plate, the overmolded framing, and electrical power connection for providing lighting at and around the shelf.

25. The refrigerator shelf of claim **24** further comprising a light source mounted to the mounting location on or in the framing.

26. The refrigerator shelf of claim **25** wherein the light source comprises a plurality of LEDs.

27. The refrigerator shelf of claim **26** wherein the LEDS comprise a linear array is along the front edge or along the undersupport of the framing.

28. The refrigerator of claim **24** wherein the glass plate and plastic plate each has a thickness and is at least substantially light transmissive and the overmolded framing is less than twice the thickness of and is substantially close to the perimeter of the glass plate.

29. The refrigerator shelf of claim **24** wherein the electrical power connection comprises an inductive coupler for receiving electrical power for operating the light source.

30. The refrigerator shelf of claim **29** wherein the inductive coupler comprises a thin receiving antenna along the glass plate, plastic plate, or framing.

31. The refrigerator shelf of claim **24** in combination with and mounted in a refrigerator cabinet, wherein the inductive coupler is adapted for operative communication inductively with an electrical power radiating antenna on or in the cabinet.

32. The refrigerator shelf of claim **24** wherein the power connection comprises a conductive element on the plastic plate or overmolding, the conductive element having a distal end adapted for conductive communication with an electrical power source in the cabinet.

33. A refrigerator shelf made according the process comprising:
a. producing a plastic plate having a perimeter;
b. overmolding light pipe material to at least a portion of the perimeter of the plastic plate;
c. mounting a light source at the overmolding light pipe material; and
d. applying a power connection to the plastic shelf to the light source.

34. The refrigerator shelf of claim **33** in combination with a mounting location in a refrigerator cabinet.

35. The refrigerator shelf of claim **33** further comprising overlaying a glass plate over the plastic plate to provide a glass upper surface for the shelf.

36. The refrigerator shelf of claim **35** wherein the glass plate is on the order of 1 mm thick.

37. The refrigerator shelf of claim **33** further comprising building into the overmolded light pipe material structure for mounting to mounting brackets that allow adjustable height mounting in the refrigerator cabinet.

38. A method of lighting shelving comprising:
a. integrating light sources into at least one of a substantially optically clear supporting plate or framing of the supporting plate, wherein the framing is not substantially thicker and does not extend substantially from the plate;
b. providing electrical power to the light sources by contact or contactless transmission;
c. operating the light sources to give the appearance of luminance at and about the supporting plate and/or illuminate surrounding areas or surfaces.

39. The method of claim **38** wherein the supporting plate comprises a thin glass upper layer and an overmolded bottom layer.

* * * * *