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(54) A shelf assembly for a refrigerator compartment

(57) A sliding or vertically step adjustable shelf includes a panel of tempered glass and two open frames. A peripheral edge of the glass panel is sandwiched between the two open frames and the latter are staked together. Alternatively, a pair of metal shelf brackets can be staked to the frames to provide vertical step-adjustment of the shelf. The vertically step-adjustable shelf can be further simplified by eliminating one of the open frame members and staking the metal shelf brackets to side frame portions of but a single outer/uppermost open frame member. In each of the shelves various components utilized in the assembly thereof, such as stake projections, heads and openings are hidden from view when the shelves are in their horizontal in-use position. Hence, each shelf presents a highly desirable aesthetic appearance, yet is strong and can be manufactured and sold at a reasonable price.

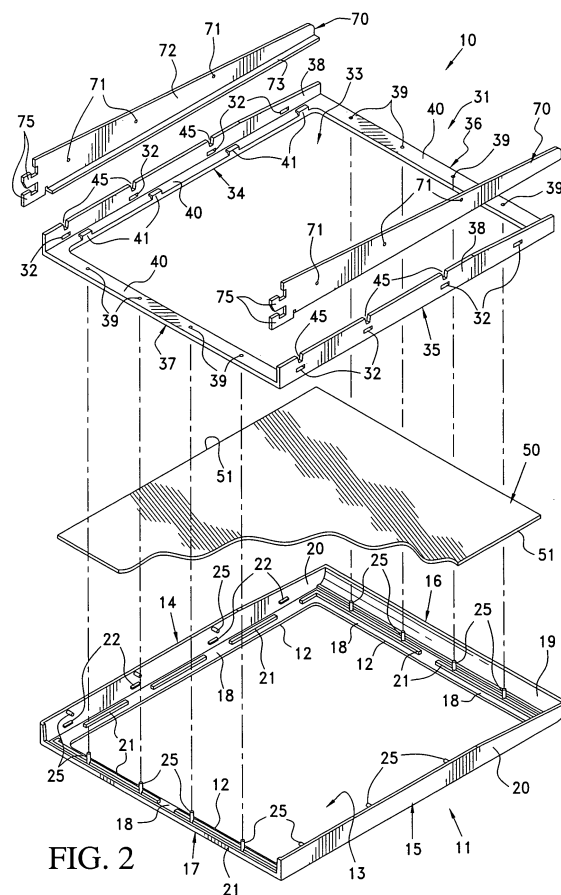


FIG. 2

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Description

BACKGROUND OF THE INVENTION

[0001] Adjustable shelves are conventionally associated with both the freezer compartment and the fresh food compartment of conventional refrigerators. Such shelves or shelf assemblies are normally constructed as cantilevered step-adjustable shelving or as a slidable shelf which slides along channels or ledges in opposite side walls of the freezer or fresh food compartment. Typical of such shelves and shelving, both sliding and cantilevered, are disclosed in the following patents.

[0002] U.S. Patent No. 1,119,982 issued to Ohnstrand discloses a glass slab 3 which sits upon "a filler 7 of suitable material, as cement" (page 1, lines 52-53). A ledge 1 of an annular frame or "truss flange 2" (page 1, line 40) supports the entire shelf. The glass slab 3 is basically "dropped-in" from above.

[0003] In lieu of bonding a piece of glass to a frame, several patents to Bienick (U.S. Patent Nos. 6,422,673 and 6,679,573) provide a sliding shelf in which a piece of tempered glass is snapped-fit into a substantially polygonal plastic frame. The latter is an innovation which excludes the utilization of separately applied adhesive and does not include complete rim encapsulation, as disclosed in U.S. Patent Nos. 5,362,145; 5,429,433 and 5,524,981, each of which are assigned to the assignee of the present application. The latter three patents require sophisticated molding techniques because a pair of metal shelf brackets and a piece of tempered glass are held accurately during the closing of an injection mold and thereafter polymeric/copolymeric material is injected into the mold creating a rim or encapsulation which holds the shelf brackets to the piece of tempered glass. Thus, glass-to-frame bonding, snap-fitting, encapsulation and the like are all quite commonplace whether the shelving assembly is slidable or can be vertically adjusted through the utilization of conventional refrigerator compartment trackways.

[0004] U.S. Patent No. 4,886,236 in the name of Randall discloses a shelf having a rim in which an edge of a piece of tempered glass is inserted, followed by the insertion of a plurality of wedge members which are driven or forced into a notch or groove which receives the edge of glass to retain the latter components assembled.

[0005] Numerous other patents disclose frames made of a single piece of plastic material, as in U.S. Patent No. 3,633,983 to Whitcomb; individual frame members, as in U.S. Patent No. 4,923,260 granted to Poulsen; extruded rims, as in U.S. Patent No. 5,947,574 in the name of Avendano; and multi-piece reinforced frames, as in U.S. Patent No. 4,960,308 in the name of Donaghy.

[0006] The shelves of the latter patents and patents listed in U.S. Patent No. 6,422,673 fairly reflect the scope and content of the prior art *as a whole* in the field of shelving, particularly shelving or shelf assemblies utilized in refrigerators, be they sliding shelves or vertically step-

adjustable shelves.

[0007] The particular shelf which is selected for a particular refrigerator depends upon numerous factors, primarily among which is price. Obviously, for so-called top-of-the-line refrigerators, more expensive, durable, aesthetic, etc. shelving is generally utilized, and the best shelving for the best and/or most expensive refrigerators is the encapsulated shelving manufactured by the assignee of the present application, and is reflected in such patents as U.S. Patent No. 5,524,981; 5,362,145; 5,429,433; etc. Such encapsulated shelving, whether sliding shelves or vertically adjustable shelves, are the so-called "Cadillac" of the industry and are utilized in most of the more expensive refrigerators found in the marketplace. As total wholesale/retail prices become more competitive, particularly toward mid-line and lower cost refrigerators, more expensive shelves, such as encapsulated shelves, can prove competitively disadvantageous, irrespective of the quality of the products and the aesthetics thereof. Because of the latter, the shelves of U.S. Patent Nos. 6,422,673 and 6,679,573 were developed because they provide excellent aesthetics at a lesser price without adversely effecting functionality. However, the optimum shelf or shelf assembly would be a combination of maximum functionality, highest aesthetics and lowest price. In an effort toward achieving the latter, the present invention provides each of the latter three objectives at as low a cost of manufacture as is possible.

BRIEF SUMMARY OF THE INVENTION

[0008] A novel shelf assembly or shelf is constructed in accordance with the present invention from but a single panel of tempered glass and two plastic frame members in the case of a sliding shelf and from a single piece of tempered glass, a single frame member, and two support brackets in the case of a vertically step-adjustable shelf or shelf assembly. In both cases, adhesive is not required and in lieu thereof, the components of the shelves, whether sliding or vertically step-adjustable, are provided with a plurality of inter-engageable stake projections and stake projection openings. When appropriately assembled, axial end portions of the stake projections are upset or staked to form enlarged heads which unitize the shelf frames to the tempered glass panel or a pair of shelf brackets, a single shelf frame and the tempered glass panel to each other in manufacturing sliding and vertically step-adjustable shelving, respectively.

[0009] In further accordance with the present invention, both in the case of a sliding shelf and a vertically step-adjusting shelf, two polymeric/ copolymeric plastic frames are utilized and are stake-assembled to each other to impart additional strength/reinforcement to the shelf assemblies.

[0010] In accordance with the present invention, in the case of a shelf assembly made of a single piece of tempered glass and two frame members, one of the frame members is provided with stake projections and the other

frame member is provided with openings for receipt therein of the stake projections. A peripheral edge of the tempered glass panel is sandwiched between the two frame members and upon staking of the axial ends of the stake projections, the three components of the shelf are securely and rigidly assembled to each other absent the addition of adhesive, bonding material, sealants or the like.

[0011] In the case of a vertically step-adjustable shelf, preferably at least one of a pair of frame members includes depending vertical flanges which carry stake projections which are inserted into and through openings of shelf brackets and are thereafter staked or headed to retain the shelf components in a rigid, unitized, aesthetic shelf assembly.

[0012] With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] **FIGURE 1** is front top perspective view of a novel shelf or shelf assembly constructed in accordance with this invention, and illustrates a pair of metal shelf brackets each having a pair of hooks, a tempered glass panel, and two generally polygonal open frame members collectively defining a rim bordering the glass panel of the shelf.

[0014] **FIGURE 2** is an exploded fragmentary perspective view of the underside of the shelf assembly of Figure 1, and from bottom to top illustrates an upper/outer polygonal open frame member, the tempered glass panel, a lower/inner polygonal open frame member and the pair of shelf brackets prior to assembly of the components.

[0015] **FIGURE 3** is a top perspective view of the shelf assembly of Figure 2 partially assembled, and illustrates a peripheral edge of the tempered glass panel sandwiched between the upper and lower polygonal open frame members with stake projections of the upper outermost open frame member being each received in a stake projection opening of the lower innermost open frame member.

[0016] **FIGURE 4** is a perspective view of the shelf assembly of Figure 3, and illustrates stake projection openings of the metal shelf brackets receiving stake projections of side frame portions of the upper open frame member.

[0017] **FIGURE 5** is a top perspective view of the shelf assembly of Figure 4, and illustrates axial ends of the stake projections being staked or enlarged to retain the components of the shelf assembly in assembled relationship.

[0018] **FIGURE 6** is an enlarged fragmentary cross-sectional view taken generally along line 6-6 of Figure 4, and illustrates the generally L-shaped transverse cross-sectional configuration of side frame portions of the inner and outer open frame members and the metal shelf

bracket; a locating member or tongue of the outer frame member snap-secured in a locating opening of the inner open frame member; a stake projection of the outer frame member projecting through a stake projection opening of the shelf bracket, and a horizontal flange of the shelf bracket engaged beneath a generally inverted L-shaped locating portion or leg of the inner open frame member with the peripheral edge of the tempered glass panel being sandwiched between horizontal flanges of the inner and outer open frame member side portions.

[0019] **FIGURE 7** is an enlarged fragmentary cross-sectional view taken generally along line 7-7 of Figure 5, and illustrates the identical components described with respect to Figure 6 and additionally illustrating an axial terminal end portion of the stake projection being staked into an enlarged staked head to retain the shelf components in assembled relationship.

[0020] **FIGURE 8** is an enlarged fragmentary cross-sectional view taken generally along line 8-8 of Figure 5, and illustrates a plurality of stake projections having enlarged stake heads disposed along a rear frame portion of the shelf assembly with axes thereof substantially normal to the axes of the stake projections of vertical flanges of the outer frame member side portions.

[0021] **FIGURE 9** is an exploded fragmentary perspective view of another shelf assembly, specifically a sliding shelf, and illustrates a pair of generally polygonal open upper and lower frame members and a polygonal tempered glass panel prior to being unitized, a plurality of abutment bars for locating the tempered glass panel relative to the upper open frame member, upwardly projecting stake projections of the latter, and stake projection openings of the lower open frame member associated therewith.

[0022] **FIGURE 10** is a perspective view of the sliding shelf or sliding shelf assembly of Figure 9, and illustrates the components staked together in assembled relationship.

[0023] **FIGURE 11** is a fragmentary enlarged cross-sectional view taken generally along line 11-11 of Figure 10, and illustrates the manner in which a peripheral edge of the polygonal tempered glass panel is sandwiched between horizontal flanges of the upper/outer and lower/inner open frame members which are in turn held together by one of a plurality of stake projections each received through a stake projection opening and retained therein by an enlarged/staked head.

[0024] **FIGURE 12** is a front fragmentary perspective view of a refrigerator including one of a pair of side-by-side compartments thereof, and illustrates the shelves of Figures 1 and 10 assembled respectively to a pair of slotted vertical trackways and slidable upon opposite side wall ledges.

[0025] **FIGURE 13** is an enlarged cross-sectional view taken generally along line 3-3 of Figure 12, and illustrates the manner in which a lower surface of a vertical flange of a side frame portion of the outer open frame member slides upon an upper surface of one of the refrigerator

compartment ledges.

[0026] FIGURE 14 is a bottom perspective view of another step-adjustable shelf or shelf assembly constructed in accordance with this invention, and illustrates an upper/outer generally polygonal open frame member, a substantially polygonal tempered glass panel, and a pair of metal shelf brackets which are collectively held in assembled relationship by a plurality of stake projections of the open frame member housed in stake projection openings of the metal shelf brackets and having at axial ends thereof enlarged staked heads.

[0027] FIGURE 15 is an enlarged fragmentary cross-sectional view taken generally along line 15-15 of Figure 14, and illustrates the components of Figure 14 in more detail, including one of the staked projections projecting through the stake projection opening and an enlarged staked head of the stake projection.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] A novel shelf or shelf assembly constructed in accordance with this invention is illustrated in Figures 1 through 8 of the drawings and is generally designated by the reference numeral 10. The shelf or shelf assembly 10 is designed for vertical step-adjustment with respect to a conventional pair of substantially vertically disposed slotted tracks T1, T2 (Figure 12) in a freezer and/or fresh food compartment C of a conventional refrigerator R which also includes opposite horizontally aligned and vertically spaced pairs of ledges L1, L2 in respective side walls S1, S2 of the compartment C for slidably accommodating another shelf 10' of the invention which will be fully described hereinafter.

[0029] The shelf assembly 10 of Figures 1 through 8 and 12 is defined by a pair of substantially polygonal open polymeric/copolymeric synthetic plastic material frame members, including an upper, uppermost, outer or outermost open frame member 11 and an inner, innermost, lower or lowermost substantially polygonal open frame member 31. The shelf assembly 10 further includes a substantially polygonal tempered glass panel or piece of glass 50 and a pair of substantially identical metal shelf brackets or shelf supporting brackets 70, 70.

[0030] The outer open frame member 11 includes an inner polygonal peripheral edge 12 defining a substantially polygonal opening 13; a pair of substantially parallel side frame member portions 14, 15; a front frame member portion 16 having a forwardly and downwardly curved finger gripping wall portion 19 and a rear frame member portion 17 which is substantially parallel to the front frame member portion 16.

[0031] The side frame member portions 14, 15 each include a horizontal flange 18 and, as viewed in Figure 1, a downwardly directed vertical flange 20 with the horizontal flanges 18, 18 of the side frame member portions 14, 15 being substantially in opposing relationship to each other.

[0032] Each horizontal flange 18, 18 of the side frame member portions 14, 15 carries means in the form of locating ribs or bars 21 which are also provided along the flanges 18, 18 continuing along the front frame member portion 16 and the rear frame member portion 17. The locating ribs, bars or abutments 21 set-off a peripheral dimension which corresponds substantially to a peripheral edge 51 of the tempered glass panel 50. This enables the glass panel 50 to be "dropped-in" inserted into the upper open frame member 11 from the position shown in Figure 2 to the position evident from Figure 3 in which the glass panel 50 is accurately located within and closes the opening 13 of the outer frame member 11.

[0033] The vertical flanges 20, 20 of the side frame member portions 14, 15 each include four inwardly directed opposing locating/latching tabs or tongues 22 which are each received in and are snap-secured to an associated locating opening 32 (Figures 2, 6 and 7) in a vertical flange 38 of the lower/inner open frame member 31. Inasmuch as the tongues 22 are aligned with the openings 32 (Figure 2), the lower open frame member 31 need not be moved downwardly from the position shown in Figure 2 into the upper/outer open frame member 11 and the tongues 22 each snaps into one of the openings 32 during the outward deflection and subsequent inward rebound of the vertical flanges 20 of the side frame member portions 14, 15.

[0034] The outer open frame member 11 also includes four stake projections 25 along the front frame member portion 16, the rear frame member portion 17 and three stake projections 25 along each of the vertical flanges 20 of the side frame member portions 14, 15. The stake projections 25 of the side frame member portions 14, 15 are in axially aligned opposing relationship to each other and axes (unnumbered) thereof are substantially normal to the axes of the stake projections 25 of the front and rear frame member portions 16, 17, respectively.

[0035] The inner/lower substantially open frame member 31 similarly includes an inner peripheral edge (unnumbered) corresponding in size to the inner peripheral edge 12 of the outer frame member 11 and defines a substantially polygonal opening 33. The inner open frame member 31 includes substantially parallel spaced side frame members portions 34, 35, a front frame member portion 36 and a rear frame member portion 37 which are oriented for aligned assembly with the respective frame member portions 14 through 17 of the outer open frame member 11.

[0036] Each of the side frame member portions 34, 35 is of a generally L-shaped transverse cross-sectional configuration (Figures 6 through 8) and is defined by the vertical depending flange 38 and a horizontal flange 40 with the horizontal flanges 40 being disposed in opposing aligned relationship. The horizontal flanges 40 carry four substantially identical L-shaped locating and retaining legs, noses or feet 41 whose ends 42 (Figure 6) are spaced above the respective horizontal flanges 40 and define therewith a locating or retaining channel 43 for a

horizontal flange 73 each of the respective shelf brackets 70, as will be more apparent hereinafter. Each of the vertical flanges 38 of the side frame member portions 34, 35 includes four of the locating openings or slots 32 heretofore described, and above three of the four locating openings 32 in each flange 38 is an upwardly opening slot 45, as viewed in Figure 2. The slots 45 of the vertical flanges 38 of the side frame member portions 34, 35 are aligned with each other and are each aligned with a stake projection receiving opening or stake projection opening 71 in a vertical flange 72 of each metal shelf bracket 70 which also includes the horizontal flanges 73 disposed in aligned opposing relationship with each other and a pair of hooks 75. The notches or slots 45 each receive or accommodate one of the stake projections 25 projecting inwardly from the vertical flanges 20 of the side frame member portions 14, 15, as is readily apparent in Figure 3. In the partially assembled condition of the shelf 10 in Figure 3, the stake projections 25 of the front frame member portion 16 and the rear frame member portion 17 of the outer frame 11 project into and through stake projection openings 39 of the respective front frame member portion 36 and rear frame member portion 37 of the inner or lower open frame member 31. The stake projections 25 of the side frame member portions 14, 15 of the outer frame member 11 each project through one of the notches 45 in the vertical flanges 38 of the side frame member portions 34, 35 of the lower frame member 31 and also pass through the stake projection receiving openings 71 of the shelf brackets 20 (Figure 4), as will be immediately described hereinafter. Thus, fourteen terminal axial ends (unnumbered) of the stake projections 25, of which eleven are illustrated in Figure 3, are accessible for subsequent staking or enlarging under heat and pressure deformation, as will be described hereinafter.

[0037] After the partial assembly of the shelf assembly 10 illustrated in Figure 3 is completed, each of the shelf brackets 70 is either slid from left-to-right, as viewed in Figures 3 and 4, to insert each shelf bracket 70 in the position shown in Figure 4 in which the stake projections 25 of the vertical flanges 20 of the side frame member portions 14, 15 project through the stake openings 71 of the shelf brackets 70 while each horizontal flange 73 is engaged beneath an associated leg 42 (Figure 6) and within the channel 43 formed thereby of each locating member 41.

[0038] In lieu of sliding the metal shelf bracket 70, 70 from left-to-right in the manner just described with respect to Figure 3, the shelf brackets 20 can be instead positioned substantially as shown in Figure 2 in side-by-side relationship to the side frame member portions 14, 34; 15, 35 of Figure 3. The horizontal flanges 73 are then merely slid under the legs or noses 41 of the locating members 41 which temporarily causes the vertical flanges 20 to deflect outwardly but subsequently rebound to the assembled position shown in Figures 4 and 6.

[0039] After the total assembly of the shelf or shelf assembly 10 of Figure 4, the exposed axial ends (unnum-

bered) of each of the fourteen stake projections 25 are simultaneously staked in a conventional manner under the application of heat and pressure resulting in the deformation of the plastic material and the formation of enlarged heads or staked heads 60 which maintain and retain the components of the shelf 10 rigidly assembled. The shelf or shelf assembly 10 can thereafter be utilized in the compartment C (Figure 12) of the refrigerator R by hooking the hooks 75 of the shelf brackets 70 in any selected horizontally aligned pair of the slots (unnumbered) in the trackways T1, T2 to afford step-adjustment of the shelf 10 in the compartment C in a conventional manner.

[0040] The shelf or shelf assembly 10' earlier alluded to is illustrated in Figures 9 through 11 of the drawings and has primed reference numerals applied thereto to identify structure which corresponds substantially identically to structure heretofore described with respect to the shelf or shelf assembly 10. However, the major difference between the two shelves 10, 10' resides in the fact that the shelf 10 includes the two metal shelf brackets 70, 70 for achieving the step-adjustment heretofore described, whereas the shelf 10' excludes such metal shelf brackets and is formed as a sliding shelf defined by three components, namely, a pair of substantially polygonal open polymeric/copolymeric synthetic plastic material frame member, including an upper, uppermost, outer or outermost open frame member 11' and an inner, innermost, lower or lowermost substantially polygonal open frame member 31'. The shelf assembly 10' further includes a substantially polygonal tempered glass panel or piece of glass 50' having a peripheral polygonal edge 51'.

[0041] The outer open frame member 11' includes sixteen upwardly directed stake projections 25' having axes substantially in parallel relationship to each other with each stake projection 25' being aligned for inter-engagement into and with stake projection receiving openings or stake projection openings 39' of the inner lower open frame member 31' (Figure 9).

[0042] As in the case of the assembly of the shelf 10 described with respect to Figures 2 through 4, the sliding shelf 10' is assembled in a similar manner by the drop-in insertion or placement of the tempered glass panel 50' into the upper open frame member 11' with the accurate location thereof being assured by the locating ribs 21'. Thereafter, the lower open frame member 31' is moved downwardly from the position shown in Figure 9 to the position shown in Figure 10 at which axial end portions (unnumbered) of each of the upwardly directed stake projections project into and through the stake projection openings 39' and with the peripheral edge 51' of the tempered glass panel 50' being sandwiched between the flanges 18', 40' of the respective open frame members 11', 31'. As is best illustrated in Figure 11, the vertical downwardly directed flange 38' of the lower open frame member 31' extends about the entire outer periphery of the lower open frame member 31' and bears against an inner surface (unnumbered) of the horizontal flange 18'

of the outer/upper open frame member 11'. Thus, the peripheral vertical flange 38' reinforces the entire periphery of the lower open frame member 31' to prevent the same from distorting under the application of heat and pressure when the axial end of each stake projection 25' is staked under heated pressure to form the enlarged staked head(s) 60' thereof (Figure 11). The sixteen staked projections 25' including the stake/enlarged heads 60' thereof maintain the sliding shelf 10' in rigid assembled relationship for its use in association with the ledges L1, L2 of the refrigerator compartment C (Figure 12) in a conventional manner. It is to be particularly noted from Figure 13 that each depending vertical flange 20' of the side frame member portions 14', 15' has a lowermost surface 65 which rides along the ledges L1, L2 and supports the shelf 10' in a manner such that the enlarged staked heads 60' are spaced well above and do not slide along upper surfaces (unnumbered) of the ledges L1, L2. This prevents the enlarged staked heads 60' from being worn under the influence of constant sliding friction during the use of the shelf 10', particularly under the load of articles positioned thereupon. Because of the absence of wear with respect to the enlarged staked heads 60', the longevity of the shelf 10' is enhanced and increased. It is also to be particularly noted that from an aesthetic standpoint, none of the stake projections 25, 25' or for that matter the locking members or tongues 22, legs 41 or the openings 32 are visible from above when the shelves 10, , 10' are in use (Figure 12). In other words, the uppermost/outermost surface (unnumbered) of the uppermost open frame members 11, 11' are essentially smooth, uninterrupted and offer no visible evidence of the internally hidden components latter-described. Thus, when viewed in the positions of use (Figure 12), the shelves 10, 10' give the appearance of an expensive high-end encapsulated shelf absent the relatively higher cost thereof while retaining the excellent functionability and high aesthetics of encapsulated shelving.

[0043] Another vertically step-adjustable shelf or shelving assembly 10''' is illustrated in Figures 14 and 15 of the drawings and corresponds in all material aspects but one to the shelf 10, namely, the shelf 10''' excludes the corresponding open inner lower frame member 31 while including the upper outer open frame member 11''', a piece of thermal glass or glass panel 50''', and a pair of metal shelf brackets 70''' each having a vertical flange 72' with a plurality of stake projection openings 71''' therein, a pair of hooks 75''' and a horizontal flange 73'''.

As is most evident from Figure 15, the peripheral edge 51''' of the tempered glass panel 50''' is accurately located and sandwiched between the flanges 18''' of the inner open frame member 11''' and the flange 73''' of each of the metal shelf brackets 70''. The stake projections 25''' of each of the vertical flanges 20''' of the outer upper open frame member 11''' project through the stake projection openings 71''' and are provided with enlarged staked heads 60''' under heat and pressure, as hereto-

fore described to assemble the components in a rigid assembly suitable for supporting products in the compartment C of the refrigerator R. However, since there are no stake projections 25''' along the front or rear member portions 16''', 17''', respectively, of the upper open frame member 11''' of the shelf 10'', an appropriate bonding material or adhesive can be utilized in these areas to glue or bond an upper surface (unnumbered) of the tempered glass panel 50''' directly to the underside of the horizontal flanges 18''' of the front and rear frame member portions 16''', 17''', respectively.

[0044] Although a preferred embodiment of the invention has been specifically illustrated and described herein, it is to be understood that minor variations may be made in the apparatus without departing from the spirit and scope of the invention, as defined by the appended claims.

Claims

1. A shelf assembly comprising a pair of substantially open frame members each defining an opening and including a plurality of at least one of stake projections and stake projection openings, a shelf panel having an outer peripheral edge sandwiched between said frame members, said stake projections projecting into said stake projection openings, and said stake projections having axial terminal ends staked to form enlarged stake heads thereby retaining said frame members and shelf panel in assembled relationship.
2. The shelf assembly as defined in claim 1 including at least one shelf support having at least one stake projection opening therein and a stake projection of at least one of said frame members being inter-engaged with said shelf support at least one stake projection opening, and said last-mentioned stake projection having a staked head retaining said shelf support and at least one frame member in assembled relationship.
3. The shelf assembly as defined in claim 1 wherein axes of at least two of said plurality of stake projections are substantially normal to a plane of said shelf panel.
4. The shelf assembly as defined in claim 1 wherein axes of at least two of said plurality of stake projections are substantially parallel to a plane of said shelf panel.
5. The shelf assembly as defined in claim 1 wherein axes of at least two of said plurality of stake projections are substantially normal to a plane of said shelf panel, and axes of at least two others of said plurality of stake projections are substantially parallel to the

plane of the shelf panel.

6. The shelf assembly as defined in claim 1 wherein one of said frame members is disposed uppermost when the shelf assembly is located in a position of use in which said shelf panel is substantially horizontal, said one frame member includes an outermost surface, and said one frame member outermost surface is devoid of discernible staked heads.
7. The shelf assembly as defined in claim 1 wherein one of said frame members is disposed uppermost when the shelf assembly is located in a position of use in which said shelf panel is substantially horizontal, said one frame member includes an outermost surface, said one frame member outermost surface is devoid of discernible staked heads, another of said frame members is disposed lowermost in the position of use, said another frame member includes an outermost surface, and discernible staked heads at said another frame member outermost surface.
8. The shelf assembly as defined in claim 1 wherein one of said frame members is disposed lowermost when the shelf assembly is located in a position of use in which said shelf panel is substantially horizontal, said one frame member includes an outermost surface, and discernible staked heads at said one frame member outermost surface.
9. The shelf assembly as defined in claim 1 including means for supporting said shelf assembly in a position of use in which said shelf panel is substantially horizontal.
10. The shelf assembly as defined in claim 1 including means for supporting said shelf assembly in a position of use in which said shelf panel is substantially horizontal, and means for locating said supporting means with respect to one of said frame members.
11. The shelf assembly as defined in claim 1 including means for supporting said shelf assembly in a position of use in which said shelf panel is substantially horizontal, and means for slidably assembling said supporting means with respect to one of said frame members.
12. The shelf assembly as defined in claim 1 including means for locating said pair of frame members relative to each other.
13. The shelf assembly as defined in claim 1 including means for snap-securing said pair of frame members relative to each other.
14. The shelf assembly as defined in claim 1 including

means for locating said shelf panel with respect to one of said frame members.

15. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and opposite spaced substantially parallel front and rear frame portions, and said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members side frame portions.
16. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and opposite spaced substantially parallel front and rear frame portions, and said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members front and rear frame portions.
17. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and opposite spaced substantially parallel front and rear frame portions, and said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members side frame portions, rear frame portions and front frame portions.
18. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and opposite spaced substantially parallel front and rear frame portions, said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members side frame portions, and axes of at least two of said stake projections are substantially normal to each other.
19. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and opposite spaced substantially parallel front and rear frame portions, said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members side frame portions, and axes of at least two of said stake projections are substantially parallel to each other.
20. The shelf assembly as defined in claim 1 wherein said frame members are each of a substantially polygonal configuration defined by opposite spaced substantially parallel side frame portions and oppo-

site spaced substantially parallel front and rear frame portions, said plurality of inter-engaged stake projections and stake projections openings are defined by said frame members side frame portions, axes of at least two of said stake projections are substantially normal to each other, and axes of at least two others of said stake projections are substantially parallel to each other.

21. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal.
22. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, and said vertical flanges project downwardly and said horizontal flanges are disposed in a substantially common horizontal plane in the position of use.
23. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, and said shelf panel outer peripheral edge is sandwiched between said horizontal flanges.
24. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, and said plurality of stake projections project from at least two of said vertical flanges.
25. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf as-

sembly is located in a position of use in which the shelf panel is substantially horizontal, and said plurality of stake projections project from vertical flanges of the same frame member.

26. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, and said plurality of stake projections project from vertical flanges of the same frame member in opposite directions.
27. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, said vertical flanges project downwardly and said horizontal flanges are disposed in a substantially common horizontal plane in the position of use, a pair of means for supporting said shelf assembly in the position of use, and means for securing one of said supporting means to at least one vertical flange of one of the frame member opposite spaced substantially parallel frame portions.
28. The shelf assembly as defined in claim 1 wherein each frame member includes opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, said vertical flanges project downwardly and said horizontal flanges are disposed in a substantially common horizontal plane in the position of use, a pair of means for supporting said shelf assembly in the position of use, means for securing one of said supporting means to at least one vertical flange of one of the frame member opposite spaced substantially parallel frame portions, and said securing means include stake projections of the last-mentioned vertical flanges projecting through openings of the supporting means each having a staked head.
29. The shelf assembly as defined in claim 1 wherein said stake projections and stake projection openings are outboard of an outer peripheral edge of said shelf panel.

30. The shelf assembly as defined in claim 1 wherein said frame members include an upper frame member and a lower frame member, said upper frame member carries at least some of said stake projections, and said lower frame member carries at least some of said stake projection openings. 5
31. The shelf assembly as defined in claim 1 wherein said frame members include an upper frame member and a lower frame member, said upper frame member carries said stake projections, and said lower frame member carries said stake projection openings. 10
32. The shelf assembly as defined in claim 1 wherein one of said frame members includes opposite side frame portions of a substantially L-shaped transverse cross-sectional configuration defined by substantially vertical and horizontal flanges, and said vertical flanges peripherally cover an outer peripheral edge of said shelf panel at said opposite side frame portions. 15
33. The shelf assembly as defined in claim 1 wherein said frame members collectively set-off uppermost and lowermost opposite surfaces of said shelf assembly, and the stake heads are located between the uppermost and lowermost opposite surfaces. 20
34. A shelf assembly comprising at least one substantially open frame member having an inner peripheral edge defining an opening and a shelf panel having an outer peripheral edge, said frame member including opposite spaced substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially downwardly directed vertical flange when the shelf assembly is located in a position of use in which the shelf panel is substantially horizontal, a pair of support brackets each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a substantially downwardly directed vertical flange in the shelf assembly position of use, said shelf panel outer peripheral edge being sandwiched between the horizontal flanges of the frame member and pair of support brackets, means for securing at least selected ones of said frame member and support brackets flanges to each other, at least one of said open frame member and said pair of support brackets being formed of synthetic polymeric/polymeric plastic material, and said securing means being defined by a plurality of inter-engaged stake projections formed of said synthetic polymeric/copolymeric plastic material and stake projection openings with the stake projections having stake heads securing said selected flanges to each other. 25 30 35 40 45 50 55
35. The shelf assembly as defined in claim 34 wherein said support brackets substantially horizontal flanges are in opposing substantially aligned relationship to each other.
36. The shelf assembly as defined in claim 34 including means for locating said shelf panel with respect to said frame member.
37. The shelf assembly as defined in claim 34 including means for locating said shelf panel with respect to said frame member, and said locating means are carried by said frame member flanges.
38. The shelf assembly as defined in claim 34 wherein said selected ones of said frame member and support bracket flanges are horizontal flanges.
39. The shelf assembly as defined in claim 34 wherein said selected ones of said frame member and support bracket flanges are vertical flanges.
40. The shelf assembly as defined in claim 34 wherein said selected ones of said frame member and support bracket flanges are horizontal flanges and vertical flanges.
41. The shelf assembly as defined in claim 34 wherein said frame member has an outermost surface, and said frame member outermost surface is devoid of discernible stake heads.
42. The shelf assembly as defined in claim 34 including means for locating said shelf panel with respect to said frame member.
43. The shelf assembly as defined in claim 34 including means for locating said shelf panel with respect to said frame member, and said locating means are carried by said frame member flanges.
44. The shelf assembly as defined in claim 35 wherein said frame member has an outermost surface, and said frame member outermost surface is devoid of discernible stake heads.
45. The shelf assembly as defined in claim 36 wherein said frame member has an outermost surface, and said frame member outermost surface is devoid of discernible stake heads.
46. The shelf assembly as defined in claim 38 wherein said frame member has an outermost surface, and said frame member outermost surface is devoid of discernible stake heads.
47. The shelf assembly as defined in claim 39 wherein said frame member has an outermost surface, and

said frame member outermost surface is devoid of discernible stake heads.

48. The shelf assembly as defined in claim 40 wherein said frame member has an outermost surface, and said frame member outermost surface is devoid of discernible stake heads.
49. The shelf assembly as defined in claim 34 wherein said frame member is formed of said synthetic polymeric/copolymeric plastic material, and said pair of support brackets are each metal.
50. A method of manufacturing a shelf assembly comprising the steps of (a) providing an open frame member formed of synthetic polymeric/ copolymeric plastic material defining an opening and including at least one frame portion of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a downwardly directed vertical flange when the shelf assembly is located in a substantially horizontal position of use with at least one of the vertical and horizontal flanges having a plurality of in situ formed synthetic polymeric/copolymeric plastic material stake projections, (b) providing a shelf panel having an outer peripheral edge, (c) providing at least one shelf bracket of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a downwardly directed vertical flange in the position of use with a plurality of stake projection openings in at least one of the last-mentioned horizontal and vertical flanges, (d) sandwiching the shelf panel peripheral edge between the horizontal flanges, (e) inserting the stake projections into the stake projection openings, and (f) staking terminal end portions of the stake projections to form enlarged stake heads.
51. The method as defined in claim 50 wherein the vertical flanges of the open frame and shelf bracket include the stake projections and stake projection openings.
52. The method as defined in claim 50 wherein the horizontal flanges of the open frame and shelf bracket include the stake projections and stake projection openings.
53. The method as defined in claim 50 wherein the vertical and horizontal flanges of the open frame and shelf bracket include the stake projections and stake projection openings.
54. The method as defined in claim 50 wherein the open

the open frame otherwise than with its uppermost surface uppermost during the performance of step (d).

55. The method as defined in claim 50 wherein the open frame includes an uppermost surface and a lowermost surface in the shelf assembly position of use and the method includes the further steps of orienting the open frame otherwise than with its uppermost surface uppermost during the performance of step (e).
56. The method as defined in claim 50 wherein the open frame includes an uppermost surface and a lowermost surface in the shelf assembly position of use and the method includes the further steps of orienting the open frame otherwise than with its uppermost surface uppermost during the performance of steps (d) and (e).
57. A method of manufacturing a shelf assembly comprising the steps of (a) providing a pair of open frame members each defining an opening and including opposite substantially parallel frame portions each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a downwardly directed vertical flange when the shelf assembly is located in a substantially horizontal position of use with the vertical flanges of one of the frame members having oppositely directed stake projections, (b) providing a shelf panel having an outer peripheral edge, (c) providing a pair of shelf brackets each of a substantially L-shaped transverse cross-sectional configuration defined by a substantially horizontal flange and a downwardly directed vertical flange in the position of use with a plurality of stake projection openings in the last-mentioned vertical flanges (d) sandwiching the shelf panel peripheral edge between the horizontal flanges of the frame members, (e) inserting the stake projections into the stake projecting openings of each shelf bracket, and (f) staking terminal end portions of the stake projections to form enlarged stake heads.
58. The method as defined in claim 57 including the step of securing the frame members to each other before performing step (e).
59. The method as defined in claim 57 including the step of snap-securing the frame members to each other before performing step (e).
60. The method as defined in claim 57 including the step of snap-securing each support bracket to an innermost frame member horizontal flange prior to the performance of step (e).

61. The method as defined in claim 57 including the step of snap-securing each support bracket to an innermost frame member horizontal flange after the performance of step (d).
62. A method of manufacturing a panel assembly comprising the steps of (a) providing a pair of open frame members each defining an opening and including a plurality of at least one of stake projections and stake projection openings, (b) providing a panel having an outer peripheral edge (c) sandwiching the panel outer peripheral edge between the pair of open frame members, (d) inserting the stake projections into the stake projection openings, and (e) staking terminal end portions of the stake projections to form enlarged stake heads.
63. The method as defined in claim 62 wherein the panel assembly frame members include an uppermost frame member and a lowermost frame member, and step (d) is performed by inserting stake projections of the uppermost frame member into stake projection openings of the lowermost frame member.
64. The method as defined in claim 62 wherein the panel assembly frame members include an uppermost frame member and a lowermost frame member, step (d) is performed by inserting stake projections of the uppermost frame member into stake projection openings of the lowermost frame member, and step (e) is performed by confining the enlarged stake heads between upper and lower surfaces of the uppermost frame member.
65. The method as defined in claim 62 including the steps of providing one of the frame members with the stake projections and providing the other of the frame members with the stake projection openings.
66. The method as defined in claim 62 wherein the panel assembly frame members include an uppermost frame member having an uppermost outermost surface and a lowermost outermost surface and a lowermost frame member having an uppermost and a lowermost surface, step (d) is performed by inserting stake projections of the uppermost frame member into stake projection openings of the lowermost frame member, and step (e) is performed by confining the enlarged stake heads between the uppermost frame member lowermost outermost surface and the lowermost frame member lowermost surface.
67. The method as defined in claim 62 wherein the frame member includes an uppermost frame member and a lowermost frame member, and providing the uppermost frame member with the stake projections and the lowermost frame member with the stake projection openings.
68. A refrigerator compartment having opposite side walls, each side wall having means for slidably supporting a shelf assembly thereon, a shelf assembly including a pair of substantially open frame members each defining an opening and including a plurality of at least one of stake projections and stake projection openings, a shelf panel having an outer peripheral edge sandwiched between said frame members, said stake projections projecting into said stake projection openings, said stake projections having axial terminal ends staked to form enlarged stake heads thereby retaining said frame members and shelf panel in assembled relationship, and one of said frame members includes opposite side frame portions each slidably supported upon one of said side wall supporting means.
69. The refrigerator compartment as defined in claim 68 wherein said stake projections and stake projection openings are outboard of said shelf panel outer peripheral edge.
70. The refrigerator compartment as defined in claim 68 wherein said frame members include an upper frame member and a lower frame member, said upper frame member carries at least one of said stake projections and stake projection openings, and said lower frame member carries at least the other of said stake projections and stake projection openings.
71. The refrigerator compartment as defined in claim 68 wherein said frame members include an upper frame member and a lower frame member, said upper frame member carries at least some of said stake projections, and said lower frame member carries at least some of said stake projection openings.
72. The refrigerator compartment as defined in claim 68 wherein said one frame member opposite side frame member opposite side frame portions is each of a substantially L-shaped transverse cross-sectional configuration defined by substantially vertical and horizontal flanges, and said vertical flanges peripherally cover said shelf panel outer peripheral edge at said opposite side frame portions.
73. The refrigerator compartment as defined in claim 68 wherein said frame members collectively set-off uppermost and lowermost opposite surfaces of said shelf assembly, and the stake heads are located between the uppermost and lowermost opposite surfaces.
74. The refrigerator compartment as defined in claim 68 wherein one of said open frame members and the stake projections thereof are a one-piece in situ

molded synthetic polymeric/copolymeric plastic material member.

75. The refrigerator compartment as defined in claim 69 wherein one of said open frame members and the stake projections thereof are a one-piece in situ molded synthetic polymeric/copolymeric plastic material member. 5
76. The refrigerator compartment as defined in claim 70 wherein one of said open frame members and the stake projections thereof are a one-piece in situ molded synthetic polymeric/copolymeric plastic material member. 10
77. The refrigerator compartment as defined in claim 71 wherein one of said open frame members and the stake projections thereof are a one-piece in situ molded synthetic polymeric/copolymeric plastic material member. 15 20
78. The refrigerator compartment as defined in claim 72 wherein one of said open frame members and the stake projections thereof are a one-piece in situ molded synthetic polymeric/copolymeric plastic material member. 25
79. The refrigerator compartment as defined in claim 73 wherein one of said open frame members and the stake projections thereof are a one-piece in situ molded synthetic polymeric/copolymeric plastic material member. 30

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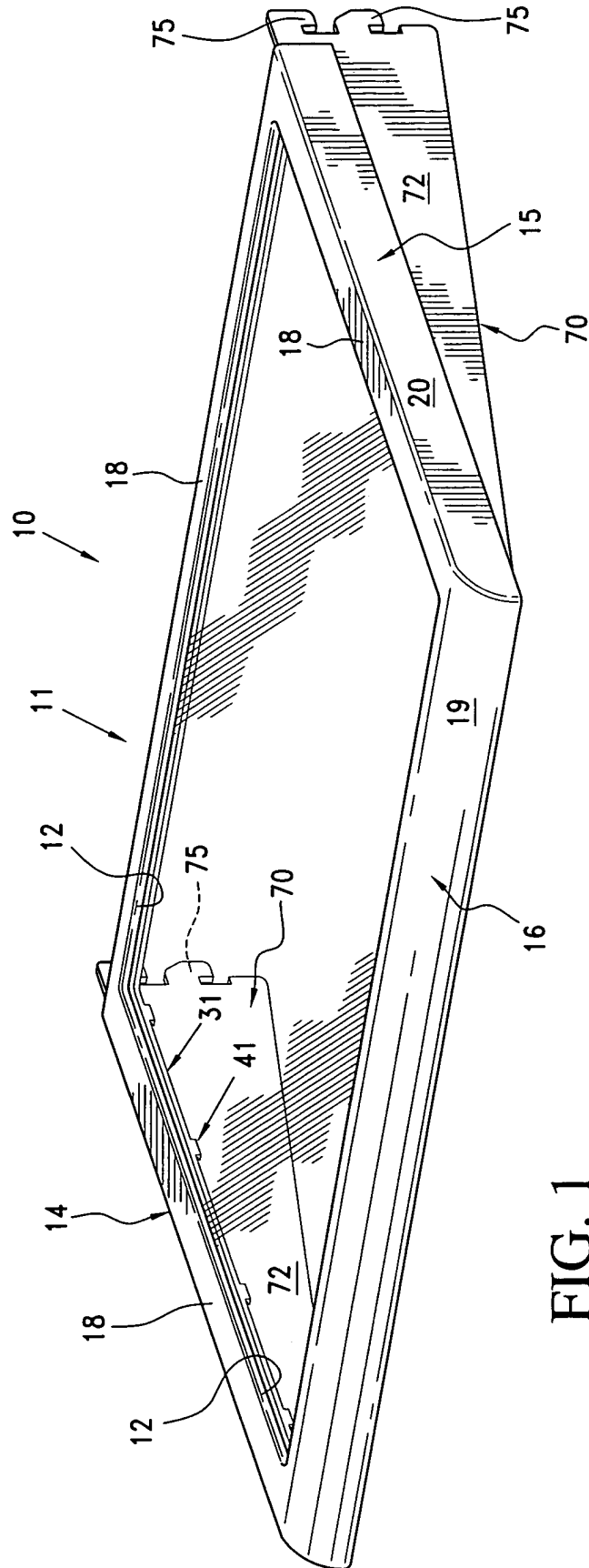
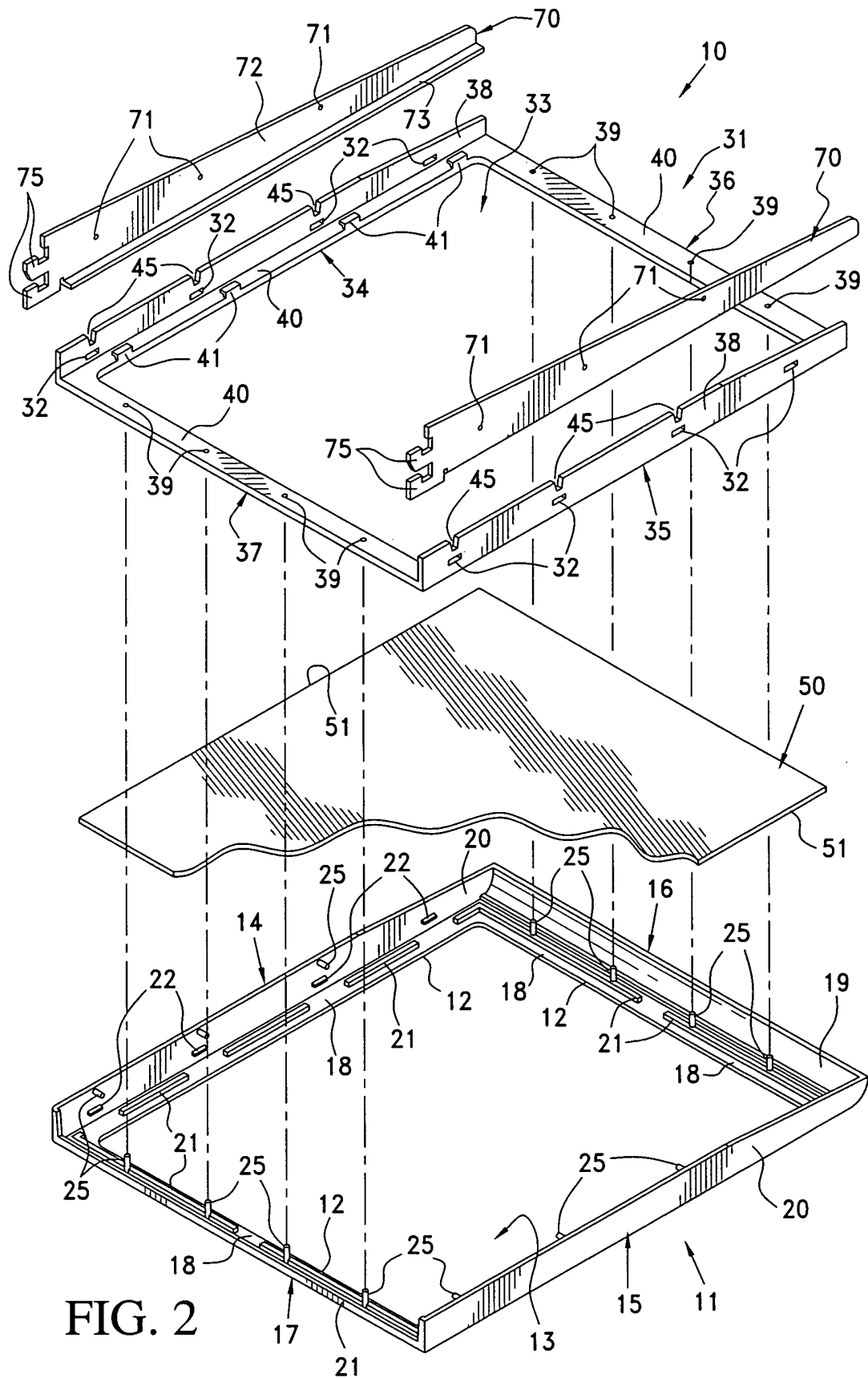


FIG. 1



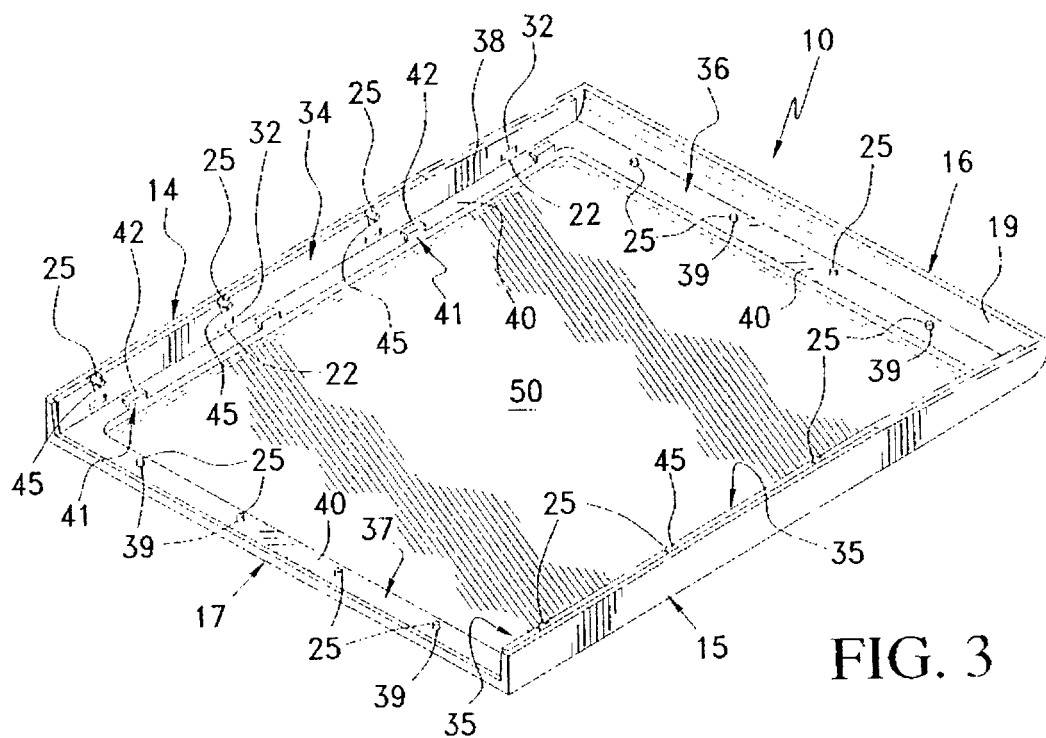


FIG. 3

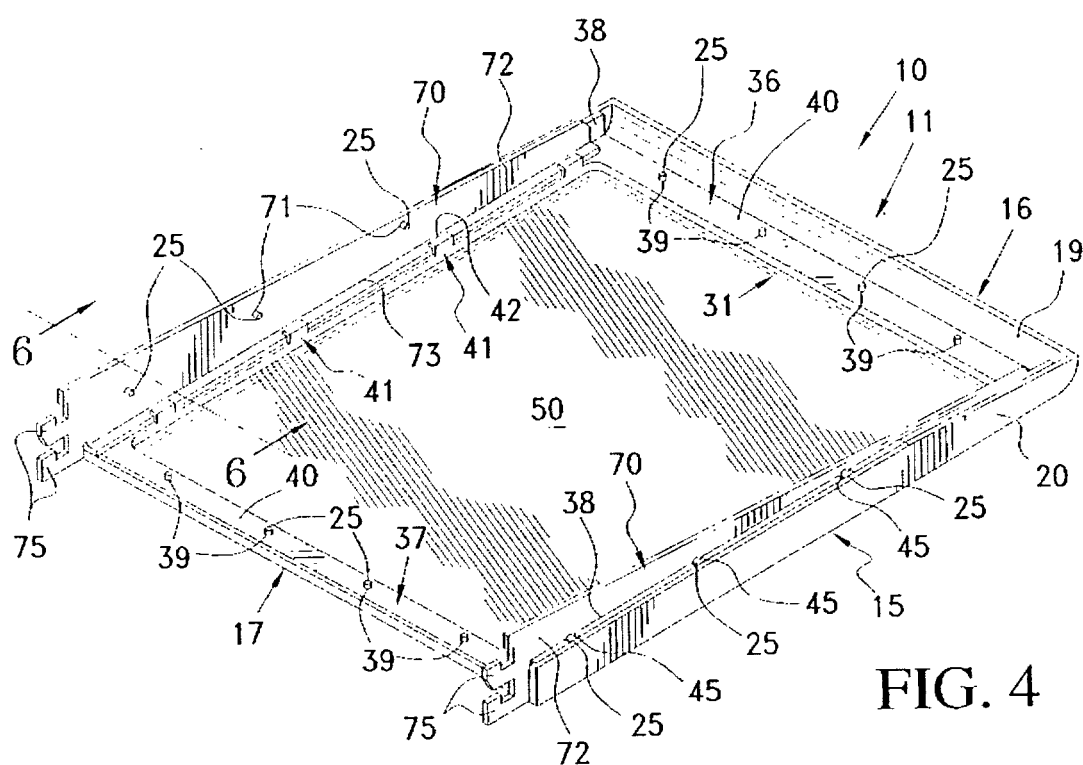


FIG. 4

FIG. 5

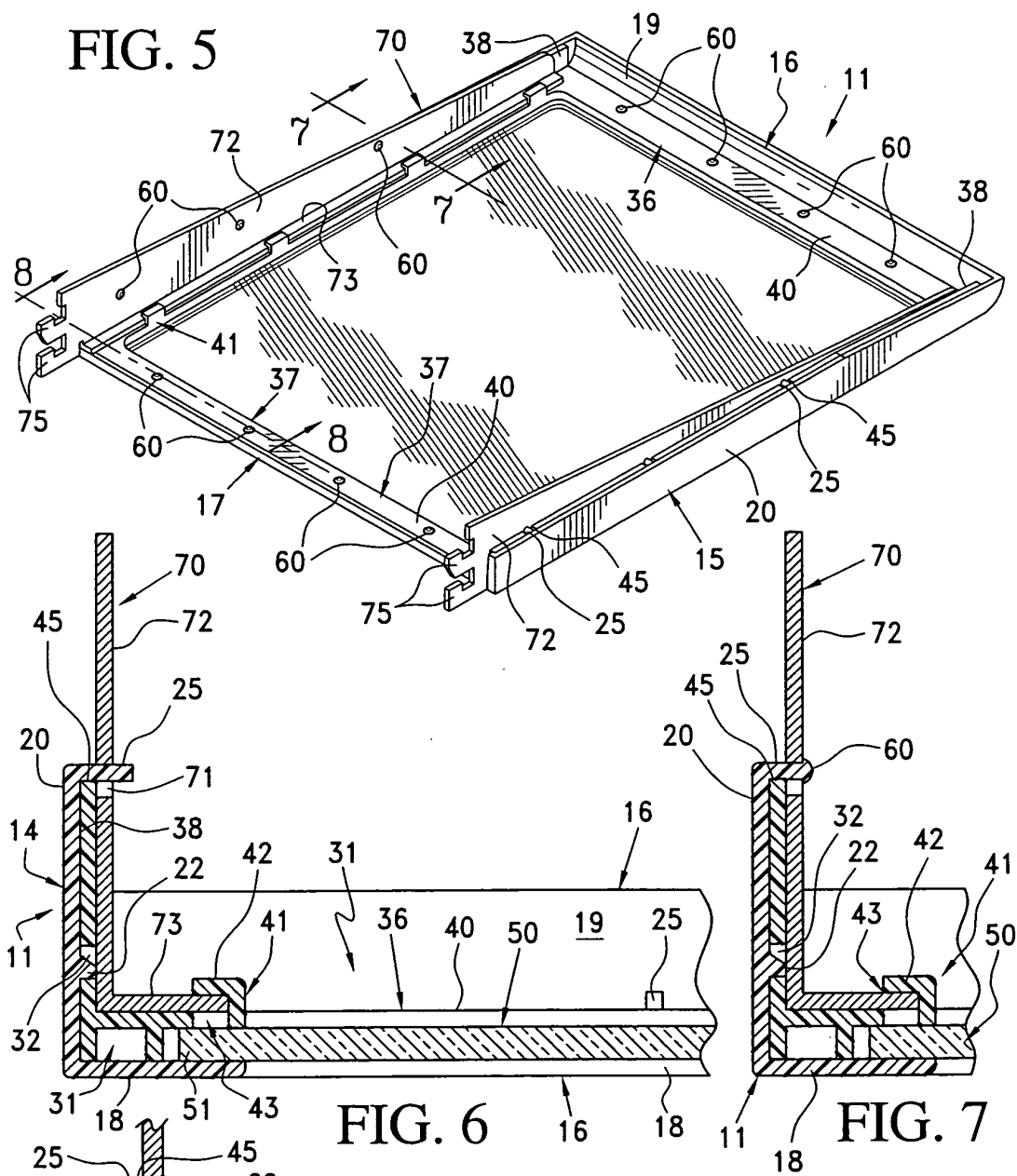
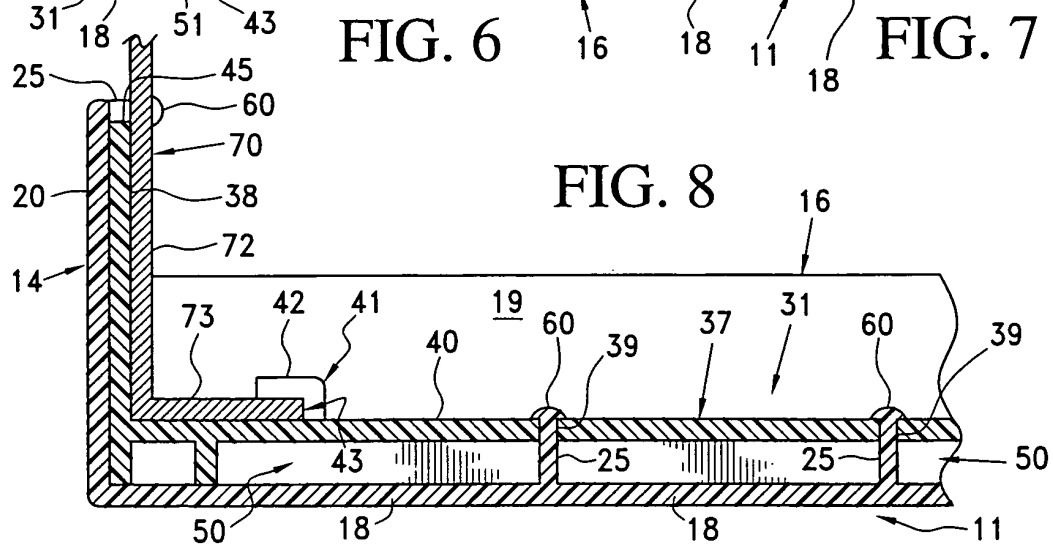


FIG. 6

FIG. 7

FIG. 8



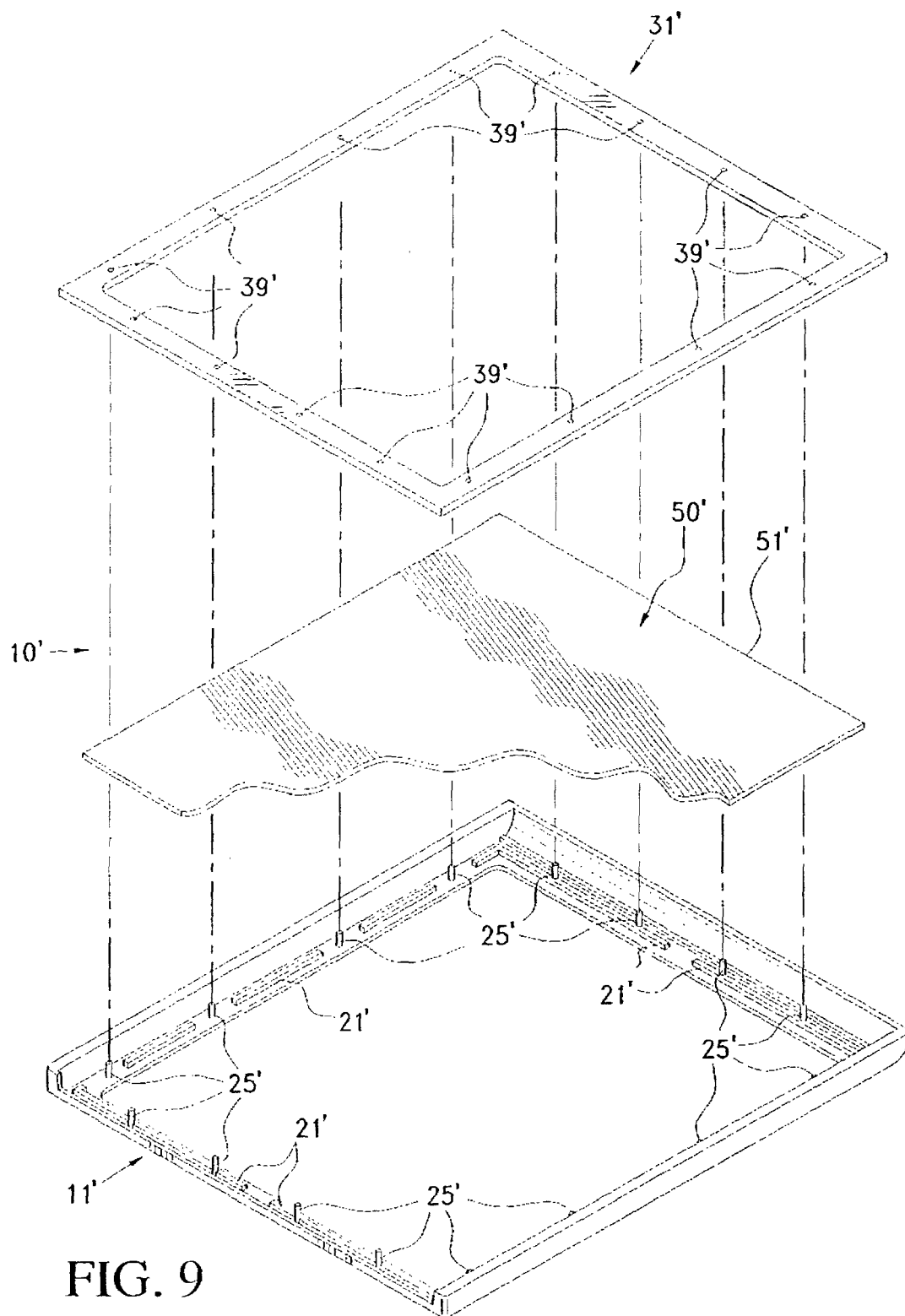


FIG. 9

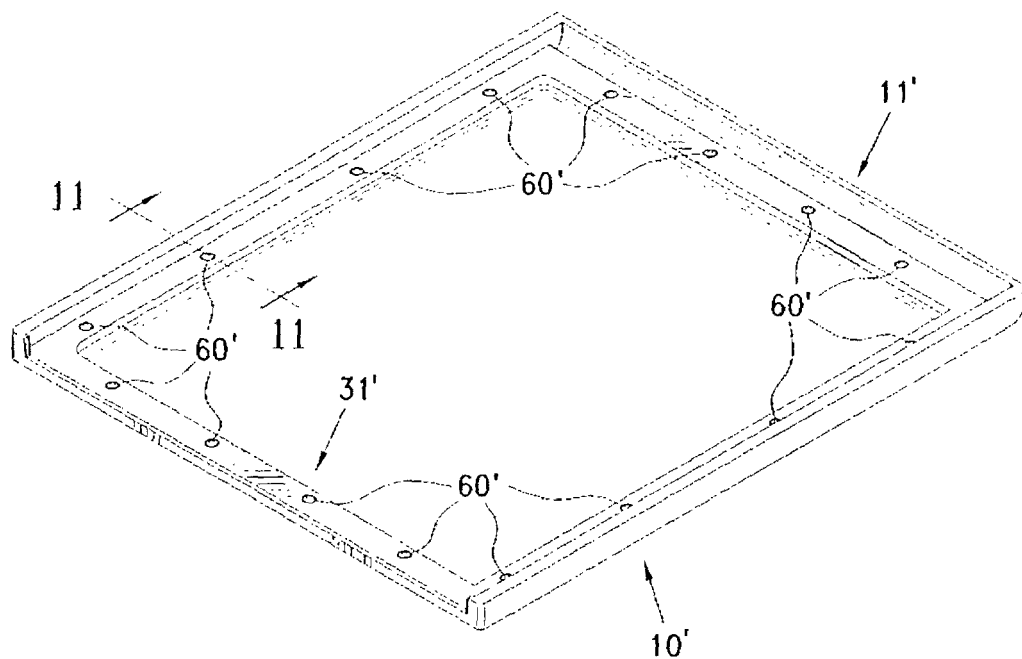


FIG. 10

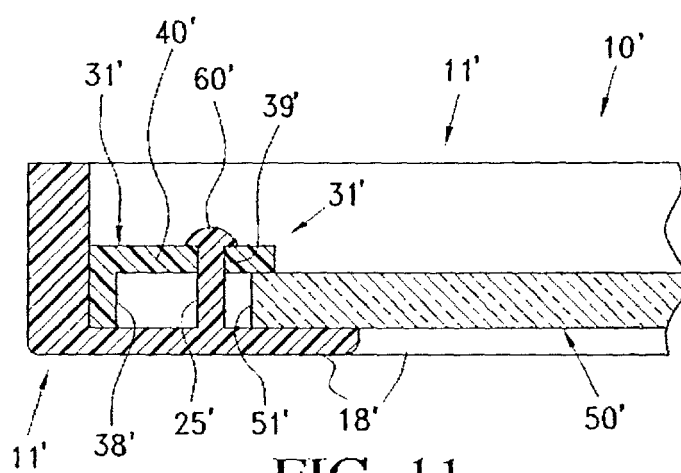


FIG. 11

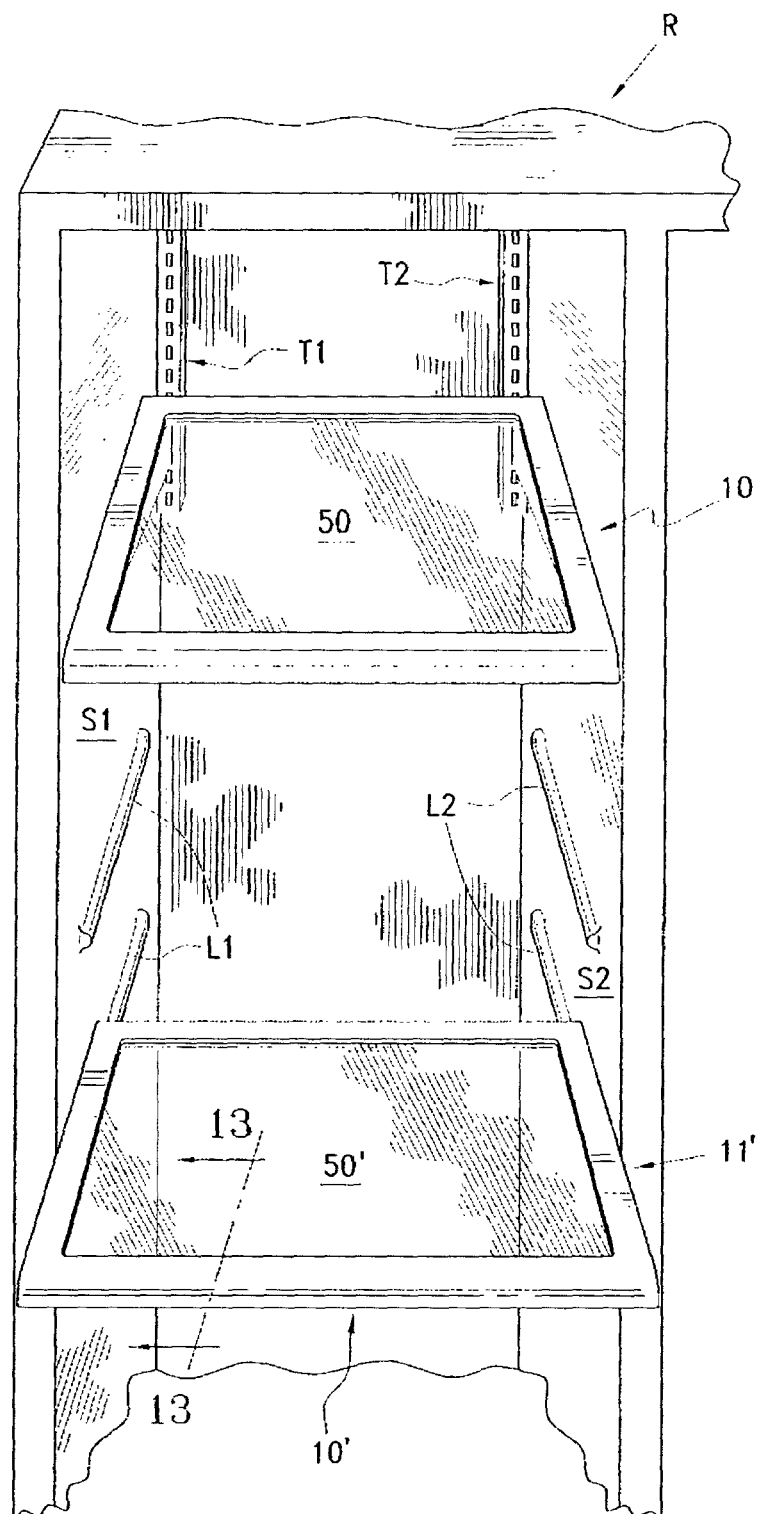
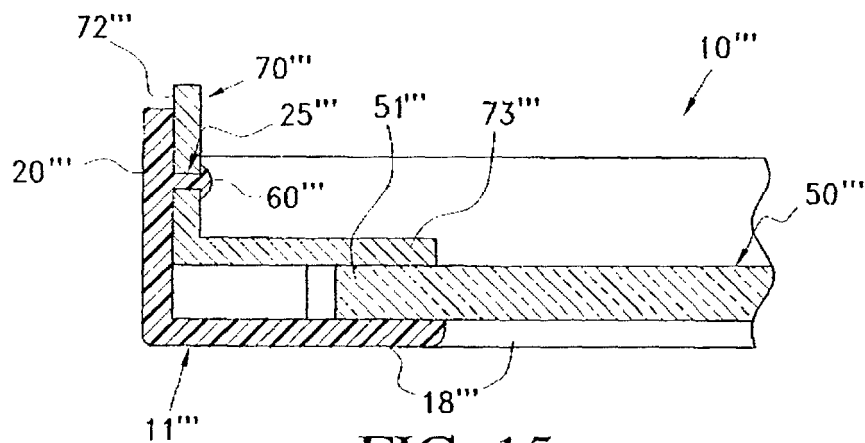
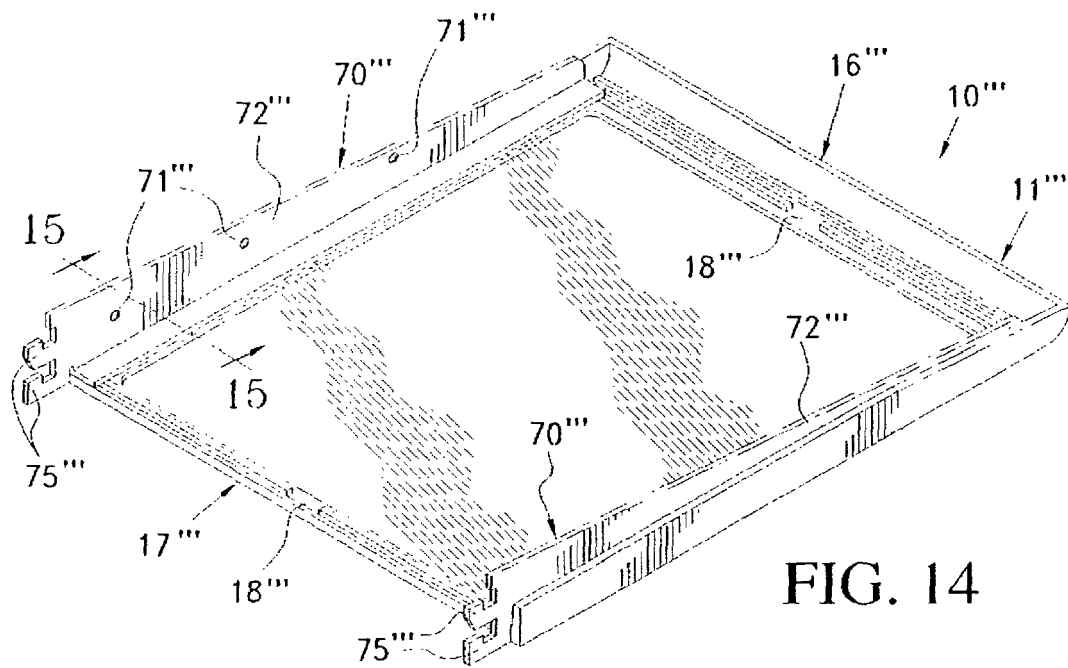
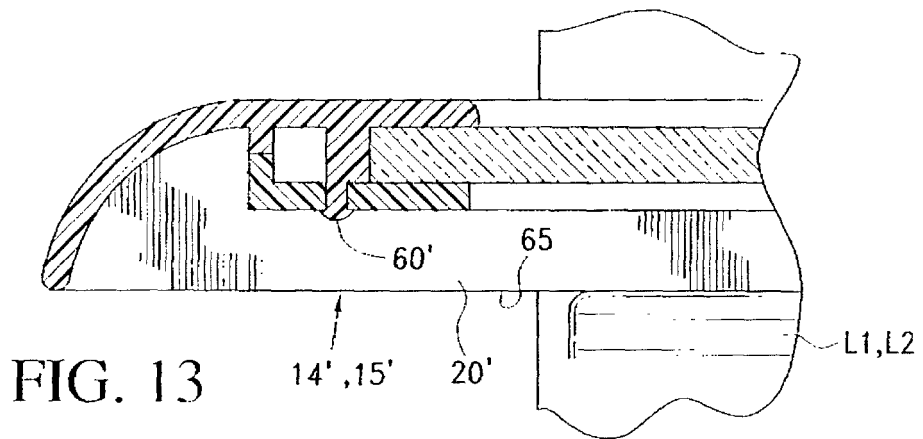


FIG. 12





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X	EP 0 605 154 A (GENERAL ELECTRIC COMPANY) 6 July 1994 (1994-07-06) * column 3, line 5 - column 5, line 5; figure 3 *	1-79	INV. F25D25/00
A	----- US 2004/104323 A1 (HUBERT STEFAN ET AL) 3 June 2004 (2004-06-03) * paragraphs [0021], [0038], [0039]; figures 14,15 *	1-79	
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A	----- US 3 219 405 A (COSTANTINI ANTHONY R ET AL) 23 November 1965 (1965-11-23) * column 4, lines 48-50 *	1-79	
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			F25D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 April 2006	Examiner Salaün, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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28-04-2006

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