



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.05.2014 Bulletin 2014/20

(51) Int Cl.:
A45C 5/14 (2006.01) **A45C 13/04 (2006.01)**
A45C 13/36 (2006.01)

(21) Application number: **12192397.3**

(22) Date of filing: **13.11.2012**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME

(72) Inventor: **Meersschaert, Reinhard**
9820 Merelbeke (BE)

(74) Representative: **Lloyd, Robin et al**
Kilburn & Strode LLP
20 Red Lion Street
London WC1R 4PJ (GB)

(71) Applicant: **Samsonite IP Holdings S.a.r.l**
1931 Luxembourg (LU)

(54) **Bottom frame construction of a luggage case**

(57) A luggage case (100) may include a bottom frame (164) to accommodate attachment of wheel assemblies (116) to a bottom panel (110) of the luggage case (100). The bottom frame (164) may include at least one first plate (186), at least one first structural element (190) defining a first longitudinal axis and operably associated with the at least one first plate (186) and extending along a first dimension thereof, and at least one second structural element (188) defining a second longitudinal

axis and operably associated with the at least one first plate (186) and extending along a second dimension thereof. The first longitudinal axis of the at least one first structural element (190) may be spaced apart from the second longitudinal axis of the at least one second structural element (188) in a third dimension. An extension of the at least one first structural element (190) may cross an extension of the at least one second structural element (188).

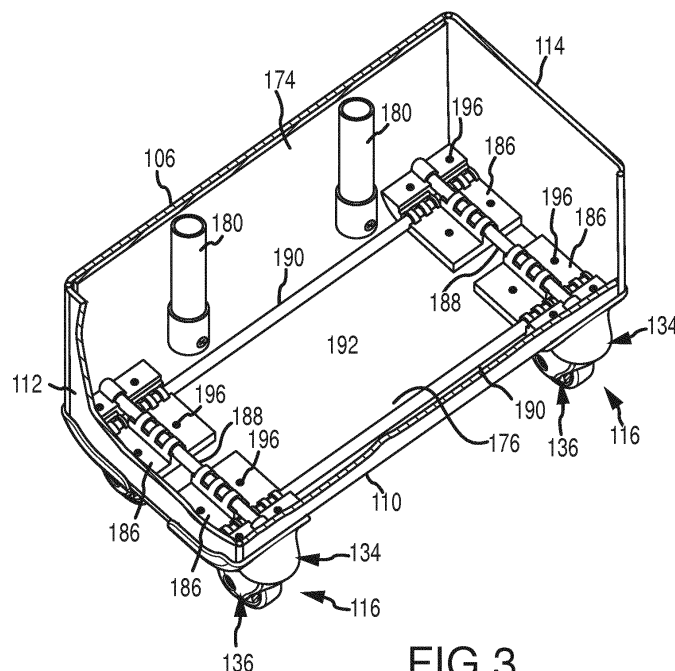


FIG.3

Description

TECHNOLOGICAL FIELD

[0001] The present disclosure generally relates to luggage. More particularly, the present disclosure relates to a luggage piece having a bottom panel, which includes a bottom frame constructed with structural elements extending between corner plates positioned at the corner regions of the bottom panel.

BACKGROUND

[0002] Luggage pieces, such as suitcases, backpacks and duffel bags, often include wheels to assist a user in moving the luggage piece along a surface. The wheels may be installed at the bottom panel of the luggage piece to allow a user to push or pull the luggage piece. To accommodate the attachment of the wheels, the luggage piece usually includes a honeycomb board positioned inside the luggage piece along the bottom panel thereof to serve as a structural platform for attaching the wheels. An inner wheel housing and an outer wheel housing for attaching each wheel to the luggage piece may sandwich portions of the bottom panel and of the honeycomb board there between to attach a wheel to a corner region of the bottom panel. To conform to the shape of the edge portions between the front or back panel and the bottom panel of the luggage piece and to conform to the upper profile of the wheel housings, the honeycomb board is heated and bent along its front and back sides. Fastener holes are formed at corners of the honeycomb board in and near the bent regions to allow fasteners to pass through to attach and position the respective wheels thereto.

[0003] To provide a stable and flat mounting structure for the wheels, precision in bending the honeycomb board and in positioning the fastener holes in the honeycomb board is required, but this is usually difficult to achieve. Furthermore, the honeycomb board adds extra weight to the luggage piece.

[0004] The present disclosure advantageously provides a bottom frame construction that does not require a honeycomb board to accommodate the attachment of the wheels, thereby reducing or minimizing the difficulties associated with bending the honeycomb board and forming the fastener holes therein. The bottom frame construction as described below is easy to fabricate, light weight, simplifies modification for different sizes of luggage, and provides a stable mounting structure for the wheels to be attached to the luggage piece.

[0005] Documents that may be related to the present disclosure in that they include various approaches to luggage case construction include, for example, EP 2363037, GB 2477087, GB 2441580, GB 2440206, GB 2361692, US 7984797, US 7896143, US 6131713, US 4813520, US 2008245633, US 2006180422, US 2003034215, US 2003019705, US 2002024189, US

2002125665, CN 201234670 and CN 201234669. These proposals, however, may all be improved.

SUMMARY

[0006] Described herein is a frame for use in pieces of luggage, such as soft side suitcases, hybrid suitcases, backpacks, duffels and so on, to accommodate attachment of wheels to a bottom panel of the luggage piece.

[0007] In some examples, the frame may include at least one first plate, at least one first structural element defining a first longitudinal axis and operably associated with the at least one first plate and extending along a first dimension thereof, and at least one second structural element defining a second longitudinal axis and operably associated with the at least one first plate and extending along a second dimension thereof. The first longitudinal axis of the at least one first structural element may be preferably spaced apart from the second longitudinal axis of the at least one second structural element in a third dimension. An extension of the at least one first structural element may preferably cross an extension of the at least one second structural element.

[0008] In some examples, a portion of the at least one first structural element and a portion of the at least one second structural element may preferably overlap. In some examples of the bottom frame, at least one of the at least one first and second structural elements may include an elongated member.

[0009] In some examples, the at least one first plate may be preferably arranged proximate to a first corner region of the bottom panel.

[0010] In some examples, the at least one first plate may include at least one first recess and at least one second recess. The at least one first structural element may be preferably operably associated with the at least one first recess. The at least one second structural element may be preferably operably associated with the at least one second recess.

[0011] In some examples, the at least one first recess and the at least one second recess may be preferably oriented substantially perpendicular to each other.

[0012] In some examples, the at least one first and second recesses may cross each other.

[0013] In some examples, the at least one first and second recesses may cross each other near a center of the first plate.

[0014] In some examples, the at least one first structural element and the at least one second structural element may divide the at least one first plate into four quadrants.

[0015] In some examples, the size of each of the quadrants may be minimized.

[0016] In some examples, the at least one first recess and the at least one second recess may preferably divide the at least one first plate into areas of similar sizes.

[0017] In some examples, the at least one first recess may include at least one first arched segment and at least

one second arched segment. The at least one first arched segment may be preferably spaced apart from the at least one second arched segment along a depth dimension of the at least one first recess.

[0018] In some examples, the at least one first recess may include a tubular structure. The tubular structure may include a continuous tube wall.

[0019] In some examples, the at least one first recess may include one or more arched segments or a continuous tubular structure.

[0020] In some examples, the at least one first recess may preferably extend along a substantial portion of a length dimension of the at least one first plate, and the at least one second recess may preferably extend along a substantial portion of a width dimension of the at least one first plate.

[0021] In some examples, the at least one first and second recesses may each include an open end and a retention end. A terminal end of the at least one first structural element may preferably about the retention end of the at least one first recess. A terminal end of the at least one second structural element may preferably abut the retention end of the at least one second recess.

[0022] In some examples, the at least one first and second recesses may be preferably configured such that the at least one first and second structural elements may be movable along the first and second longitudinal axes, respectively, and/or rotatable within the at least one first and second recesses, respectively. Such movements and/or rotation may make it easier to position the assembled bottom frame into the luggage case and fit it to the bottom panel thereof. Such movements and/or rotation may also help to absorb impact from the wheels when incorporated to the luggage case thereby protecting the structure of the luggage case.

[0023] In some examples, the at least one first plate may include at least one top surface and at least one bottom surface. A substantial portion of the at least one first recess may preferably be positioned between the at least one top surface and the at least one bottom surface along at least a portion of a length dimension of the at least one first plate. A substantial portion of the at least one second recess may preferably be positioned above the at least one top surface along at least a portion of a width dimension of the at least one first plate.

[0024] In some examples, the at least one first structural element may extend across at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of a length dimension of the at least one first plate. The at least one second structural element may extend across at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of a width dimension of the at least one first plate. Configuring the first and second structural elements to extend across a substantial portion of the first plate may improve stability of the luggage case.

[0025] In some examples, the luggage case may further include a wheel assembly operably coupled to the

at least one first plate.

[0026] In some examples, the luggage case may further include at least one wheel housing which may include a plurality of fastener receiving structures. The at least one first plate may include a first plurality of apertures corresponding to the plurality of the fastener receiving structures of the at least one wheel housing. The at least one first and second structural elements may define a plurality of corner areas of the at least one first plate. At least one of the plurality of corner areas of the at least one first plate may preferably include at least one aperture of the first plurality of apertures. Having the first plurality of apertures formed in the divided corner areas of the first corner plate may promote an even distribution of the support by the wheel assembly onto the corner plate.

[0027] In some examples, the bottom frame may further include at least one second plate preferably arranged in a second corner region of the bottom panel. One of the at least one first and second structural elements may be operably associated with the at least one second plate. The at least one first plate may be proximate to a first edge of the bottom panel. The at least one second plate may be proximate to a second edge of the bottom panel substantially parallel to the first edge of the bottom panel. The at least one second plate may include a second plurality of apertures for operably associating the at least one second plate with the bottom panel. At least one of the first plurality of apertures may be preferably configured closer to the first edge than at least one of the second plurality of apertures to the second edge. Forming the apertures closer toward an edge of the bottom panel of the luggage case allows for the wheel assemblies to shift outward to form a larger support area for the luggage case. In the case where only the wheel assemblies near the front panel of the luggage case are shifted outward, the supported area can be increased without increasing the overall dimension of the luggage case since the front panel still remains as the outer most surface.

[0028] In some examples, the at least one first and second structural elements may be relatively flexible or flex upon impact, thereby allowing for resilient bending of the bottom frame. Such resilient bending, as well as the longitudinal and/or rotational movements of the structural elements, allows for the bottom frame to act as a suspension system to protect the wheel assemblies and the luggage case from damage that may be caused by excess forces exerted onto the wheel assemblies.

[0029] In some examples, the at least one first and second structural elements may be preferably operably associated with the at least one first plate before the frame is operably associated with the bottom panel of the luggage case.

[0030] In some examples, at least one of the at least one first and second structural elements may include a circular cross section.

[0031] In some examples, at least one of the at least

one first and second structural elements may include a hollow or solid center along the longitudinal axis thereof.

[0032] This summary of the disclosure is given to aid understanding, and one of skill in the art will understand that each of the various aspects and features of the disclosure may advantageously be used separately in some instances, or in combination with other aspects and features of the disclosure in other instances.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Fig. 1 is a front perspective view of a wheeled luggage case incorporating a bottom frame for attachment of the wheels.

[0034] Fig. 2 is a bottom perspective view of the luggage case shown in Fig. 1.

[0035] Fig. 3 is a partial schematic top perspective view of the luggage case shown in Fig. 1, with the upper portion of the luggage case cut away, and incorporating a bottom frame.

[0036] Fig. 4 is an exploded top perspective view of the luggage case shown in Fig. 1, with the front panel and inner and outer cover layers removed, and incorporating a bottom frame.

[0037] Fig. 5 is an exploded bottom perspective view of the luggage case shown in Fig. 1, with the front panel and inner and outer cover layers removed, and incorporating a bottom frame.

[0038] Fig. 6 is an exploded top perspective view of a bottom frame.

[0039] Fig. 7 is an exploded bottom perspective view of the bottom frame shown in Fig. 6.

[0040] Fig. 8A is a top perspective view of a corner plate of the bottom frame shown in Fig. 6.

[0041] Fig. 8B is a bottom perspective view of the corner plate shown in Fig. 8A.

[0042] Fig. 8C is a top plan view of the corner plate shown in Fig. 8A.

[0043] Fig. 8D is a bottom plan view of the corner plate shown in Fig. 8A.

[0044] Fig. 9A is a top perspective view of a corner plate of the bottom frame shown in Fig. 6, with portions of two structural elements to be operably associated with the corner plate.

[0045] Fig. 9B is a cross section view of the corner plate shown in Fig. 9A, with one structural element operably associated with the corner plate, viewed along line 9B-9B in Fig. 9A. The other structural element is not shown in Fig. 9B.

[0046] Fig. 9C is a cross section view of the corner plate shown in Fig. 9A, with both structural elements operably associated with the corner plate, viewed along line 9C-9C in Fig. 9A.

[0047] Fig. 10A is schematic rear elevation view of a portion of the luggage case shown in Fig. 1.

[0048] Fig. 10B is a schematic cross section view of the portion of the luggage case shown in Fig. 10A, viewed along line 10B-10B in Fig. 10A.

[0049] Fig. 11 is a schematic top plan view of a corner portion of the bottom panel of the luggage case shown in Fig. 3, illustrating an alternative position, in dashed lines, of a wheel with respect to the corner plate.

[0050] Fig. 12A is a top perspective of another example of a corner plate.

[0051] Fig. 12B is a bottom perspective of the corner plate shown in Fig. 12A.

[0052] Fig. 13 is a top perspective view of a bottom frame incorporating the corner plate shown in Figs. 12A and 12B.

[0053] Fig. 14 is a top perspective view of the L-shaped kick plate as shown in Fig. 13.

DETAILED DESCRIPTION

[0054] Figs. 1 and 2 show a luggage case 100 that includes a main housing compartment 102 having a front panel 104, a rear panel 106, a top panel 108, a bottom panel 110, a left side panel 112, and a right side panel 114. The luggage case 100 may include wheel assemblies 116 attached to the main housing compartment 102 adjacent the corners of the bottom panel 110. The luggage case 100 may further include one or more carry handles 118, 120 to lift or otherwise move the luggage case 100, and a telescoping handle 122 to pull or push the luggage case 100 along a support surface.

[0055] The front panel 104 may be pivotally connected to a rim 124 of the luggage case 100 along a side edge of the front panel 104, and may include a zipper 126 that may run along the other edges of the front panel 104 to selectively secure the front panel 104 to the rim of the luggage case 100 and to allow a user to access an interior compartment defined by the panels 104, 106, 108, 110, 112, 114 of the luggage case 100. The front panel 104 may include additional compartments 128 that may be defined by pockets inside or outside the luggage case 100. Access to such pockets 128 may be provided using a zipper 130 or any other suitable opening/closure mechanism, such as Velcro®. The exterior surface of the luggage panels 104, 106, 108, 110, 112, 114 may be soft and may be formed from any type of material used to form soft side luggage pieces including, but not limited to, natural or man-made woven or non-woven fabrics, or natural materials, such as leather.

[0056] The luggage case 100 may further include structures, such as inner liners, structural sheets in the various walls of the panels, and interior pockets, clips, hooks and hangers. The luggage case 100 may include edge piping 132 to help protect the outer corners of the luggage case 100 from scuffs and abrasions, among other things.

[0057] With reference to Figs. 2, 3, 4, 5, 10A and 10B, the wheel assemblies 116 will be discussed in more detail. The luggage case 100 may include four spinner wheel assemblies 116, with one spinner wheel assembly 116 attached to the bottom panel 110, adjacent to a corner thereof. Each spinner wheel assembly 116 may in-

clude an outer wheel housing 134 joined to the bottom panel 110 of the luggage case 100 and a swivel caster 136 rotatably joined to the outer wheel housing 134. The outer wheel housing 134 may include a relatively flat base portion 138, a curved end portion 140 extending from the relatively flat base portion 138, and a side portion 142 extending at an approximate right angle from the relatively flat base portion 138. The relatively flat base portion 138 may generally conform to a portion of the bottom panel 110 of the luggage case 100, the curved end portion 140 may generally conform to edge portions between the front or rear panels 104, 106 and the bottom panel 110, and the side portion 142 may generally conform to portions of the left or right side panels 112, 114 respective of the location of the particular wheel assembly 116.

[0058] Referring to Fig. 2, 10A and 10B, the outer wheel housing 134 may also include a collar 144 (recess portion) defining a recess 146 extending downward substantially perpendicular from the relatively flat base portion 138. The collar 144 (recess portion) may be configured to receive at least a portion of the swivel caster 136. The swivel caster 136 may include a yoke mount 150 and a wheel 152. At least a portion of the upper portion of the yoke mount 150 may be configured to be received within the collar 144 (recess portion) of the outer wheel housing 134, and may be rotatably coupled to the outer wheel housing 134 through an axle, a shaft, or any suitable fastener 154 that allows for a 360 rotation of the swivel caster 136. The lower portion of the yoke mount 150 may include two arms 156, and the wheel 152 may be positioned between the two arms 156 of the yoke mount 150 and rotatably coupled to the two arms 156 by a wheel core 158 and a central axle 160.

[0059] With reference to Fig. 4, the outer wheel housing 134 may further include screw bosses or thread posts 162 selectively positioned on an upper surface of the outer wheel housing 134. The screw bosses or thread posts 162 may extend upward from the upper surface of the outer wheel housing 134. The screw bosses or thread posts 162 may allow for attachment of the outer wheel housing 134 to the bottom panel 110 of the luggage case 100, as is described in more detail below. Although screw bosses or thread posts 162 are described herein, any other suitable fastening mechanisms may be used for attachment of the outer wheel housing 134 to the bottom panel 110 of the luggage case 100, such as adhesive, welding, rivets and so forth.

[0060] It should be noted that four spinner wheel assemblies 116 operably coupled to the bottom panel 110 of the luggage case 100 are described herein as an example. The luggage case 100 may include various number and/or types of wheels. The luggage case 100 may include a combination of wheels and supporting feet instead, or any other configuration as desired. The wheels and/or supporting feet may be joined to other panels as desired, such as a side panel 112, 114 and/or the bottom panel 110 of the luggage case 100.

[0061] With reference to Figs. 1, 2, 3, 4 and 5, an ex-

ample assembly structure of the luggage case 100, in particular assembly of a bottom frame 164 and spinner wheel assemblies 116 to the bottom panel 110 of the luggage case 100, is described in more detail.

[0062] Fig. 3 shows a portion of the luggage case 100 shown in Fig. 1 incorporating an implementation of the bottom frame 164 described herein. A top portion of the luggage case 100 is cut away, and the front panel 104 and the inner liner 166 are removed to better illustrate the structural elements, especially those associated with the bottom frame 164 of the luggage case 100, included therein. Figs. 4 and 5 show exploded top and bottom perspective views of the luggage case 100 shown in Fig. 1 and incorporating the bottom frame 164 described herein. The outer cover 168 and the inner liner 166 are removed to better illustrate the structural elements included therein.

[0063] As best shown in Figs. 4 and 5, the luggage piece 100 may include a C-shaped structural sheet 170 inside the luggage case 100 that helps to retain the shape and integrity of the luggage case 100. The structural sheet 170 may have top, rear and bottom sections 172, 174, 176 corresponding to the top, rear and bottom panels 108, 106, 110 of the luggage case 100 that help to retain the shape thereof. The top section 172 of the structural sheet 170 may include an opening 178 configured to receive a telescoping handle 122. The rear section 174 of the structural sheet 170 may include apertures configured to allow fasteners to pass through to securely attach portions of the telescoping handle poles 180 to the rear section 174 of the structural sheet 170. The bottom section 176 of the structural sheet 170 may include at each corner region a set of apertures 182 at locations corresponding to the screw bosses of thread posts 162 of the particular outer wheel housing 134 of the spinner wheel assembly 116 to be attached. (Although not shown, apertures may be formed at corner regions of the bottom panel 110 of the luggage case 100 at similarly corresponding locations.) Although a C-shaped structural sheet 170 is described herein, the structural sheet 170 may take any suitable shape. The structural sheet may extend along the inside of only one or two of the top, rear and bottom panels 108, 106, 110. The structural sheet 170 may take any shape along each panel including, but not limited to, a shape with straight-lined contour (such as a rectangular shape), a shape with curved contour (such as an hour glass shape), or any other suitable shape. It is to be noted that, depending on the shape thereof, the structural sheet 170 may not be positioned between the connecting pieces 186 of the bottom frame 164 as described below and the outer wheel housing 134. Additionally, the structural sheet 170 may be formed as a continuous piece, or may be formed as multiple pieces received in the various walls of the panels of the luggage case 100. The structural sheet 170 may be made of polypropylene (PP), polyethylene (PE), or any other suitable material. As described herein, the connecting pieces 186 are also referred to as corner plates, corner

pieces and connecting plates.

[0064] As shown in Figs. 2, 4 and 5, the luggage case 100 may further include a pair of reinforcing wires 184 received within the piping 132 extending along the peripheral of the left and right side panels 112, 114. The reinforcing wires 184 may provide additional shape and structural support to the luggage case 100, as is known.

[0065] The luggage case 100 may include a bottom frame 164 therein operably coupled to the bottom panel 110 of the luggage case 100, the wheel assemblies 116, and/or the structural sheet 170. The bottom frame 164 helps to prevent the bottom section 176 of the structural sheet 170 and the bottom panel 110 of the luggage case 100 from buckling when the luggage case 100 is loaded and force is exerted on the wheel assemblies 116, and advantageously provides a strong, light-weight and structural sound bottom panel 110.

[0066] As best shown in Figs. 3 and 4, the bottom frame 164 may include four structural elements 188, 190 operably coupled to four connecting pieces (or corner plates) 186 arranged near four corner regions of the bottom panel 110 of the luggage case 100. When assembled together, this frame structure 164 is strong and light, and allows easy assembly with the rest of the luggage case 100 during assembly. The four structural elements 188, 190 may be arranged in a generally planar rectangular configuration, with a structural element 188, 190 defining each side of the frame 164. More specifically, two relatively shorter structural elements 188 may be oriented in a substantially parallel relationship, two relatively longer structural elements 190 may be oriented in a substantially parallel relationship, and the orientations of the relatively shorter structural elements 188 may be substantially perpendicular to the orientations of the relatively longer structural elements 190. The adjacent ends of any two structural elements 188, 190 form a corner of the bottom frame 164, and are connected together by one of the four connecting pieces 186. The bottom frame 164, in this configuration, defines a supported area 192 when integrated into the bottom of the luggage case 100. The longer 190 and shorter 188 structural elements each may extend parallel to an adjacent edge 111 and 113 of the bottom panel 110 (see Fig. 3).

[0067] In some examples, the four structural elements 188, 190 may be elongated members or pulltrusions, including, but not limited to, rods, struts, or tubes, having longitudinal axes along their respective length dimensions or extending orientations. Depending on the shape and form of the structural elements 188, 190, the longitudinal axis, length dimension and orientation of a structural element 188, 190 may align and may be used herein interchangeably.

[0068] In continuing reference to Fig. 3, 4, 5, 6 and 7, each of the connecting pieces 186 may include a set of apertures 194 at locations corresponding to the screw bosses or threaded posts 162 of the particular outer wheel housing 134 of the spinner wheel assembly 116 to which the connecting piece 186 may be attached. Fas-

teners 196 may be positioned through the apertures 194 in the connecting pieces 186 and received in the screw bosses or thread posts 162 on the outer wheel housing 134 to attach each of the connecting pieces 186 to respective wheel assemblies 116. The screw bosses or thread posts 162 may be positioned through the apertures in the bottom panel 110 of the luggage case 100 and the structural sheets 170 as described earlier. Accordingly, the corner piece 186 and the outer wheel housing 134 may secure the bottom section 176 of the structural sheet 170 and the bottom panel 110 of the luggage case 100 there between. Note that more, fewer, or different structures may be secured between the connecting piece 186 and corresponding outer wheel housing 134 depending on the desired structure.

[0069] The bottom frame 164, including the structural elements 188, 190 and the connecting pieces 186, may define a unitary structure separate from the luggage case 100, thus allowing for the bottom frame 164 to be assembled outside the luggage case 100. As will be described in more detail below, the assembled bottom frame 164 may have significant stiffness yet allowing for some resilient bending out of plane as defined by the structural elements 188, 190, thereby making it easier to position the assembled bottom frame 164 inside the luggage case 100 during final assembly.

[0070] With reference to Figs. 6 to 9, the connecting pieces 186, the structural elements 188, 190, and the assembly to form the bottom frame construction 164, are described.

[0071] Figs. 6 and 7 show, respectively, a top and bottom perspective exploded view of the bottom frame 164 with all four structural elements 188, 190 not connected to their respective connecting pieces 186.

[0072] As described earlier and with reference to Fig. 6 and 7, the structural elements 188, 190 may be linear elongated members or pulltrusions including, but not limited to, rods, struts, or tubes, having longitudinal axes along their respective length dimensions or orientation. The structural elements 188, 190 may be formed as solid or hollow pieces to provide the desired structural and shape support to the bottom frame 164. In some examples, where the structural elements 188, 190 may be hollow tubular structures, the cross section of the hollow tubular structures may have an inner diameter of 7 mm and an outer diameter of 8 mm to provide sufficient structural support for the luggage case 100 and the wheel assemblies 116 attached thereto while keeping the weight relative low. Other inner and/or outer diameters may be used. In other examples, the structural elements 188, 190 may be solid elongated structures. The cross section of the solid elongated structures may be circular, and may have a diameter of 6 mm. Although tubular or circular cross sections are described herein, it is contemplated that the structural elements 188, 190 may have cross sections of any suitable shapes, such as square, rectangular, I-beam, or U-shape. It should be noted that all dimensions referenced are approximate unless oth-

erwise noted. The structural elements 188, 190 may have relatively smooth outer surfaces and/or relatively smooth inner surfaces. The structural elements 188, 190 may have grooves formed in the inner and/or outer surfaces. The structural elements 188, 190, while shown as being linear, may be curved or axially twisted along their lengths. Additionally, each structural element 188, 190 may be made up of more than one member attached together to act as a single structural element.

[0073] With reference to Figs. 3, 8A-D, the connecting pieces 186 will be described in more detail. Fig. 8A shows a top perspective view of a connecting piece 186 of the bottom frame 164 that is positioned near the rear panel 106 and the right side panel 114 of the luggage case 100, or positioned near the front panel 104 and the left side panel 112 of the luggage case 100 shown in Fig. 3. The connecting pieces 186 may be formed as a plate or in a general plate-like shape with a top side 198, a bottom side 200 and a plurality of outer perimeter walls 202, 204, 206 extending between the top and bottom sides 198, 200 together forming a rectilinear shape. To conform to the shape of the edge portions between the front/back panel 104, 106 and the bottom panel 110 of the luggage case 100 and to conform to the upper profile of the outer wheel housing 134 of a wheel assembly 116, the bottom side 200 of the connecting piece 186 may include a curved portion 208. The curved portion 208 and the top side 198 may converge along a side of the rectilinear shape, forming a converging edge 210.

[0074] As best seen in Fig. 8A, the connecting piece 186 may be formed with a first recess structure 212 defining a first axis and a second recess structure 214 defining a second axis. The first and second recess structures 212, 214 may each be configured to receive a structural element 188, 190 to form the bottom frame 164. The first axis of the first recess structure 212 may be substantially perpendicular to the second axis of the second recess structure 214, and may be in different vertical planes (relative to Figs. 8C and D) such that the two structural elements 188, 190 received within the first and second recesses cross each other and may be orthogonally oriented.

[0075] The first recess structure 212 may further include a first retention end or a first end wall 216 arranged at an end of the first recess structure 212 that may be configured to prevent the structural elements 190 from extending beyond the outer perimeter wall 206 near a side panel 112, 114 of the luggage case 100. The first end wall 216 may be flush with or form a portion of the outer perimeter wall 206. The first end wall 216 may not form a portion of the outer perimeter wall 206, and may be arranged at any location along the first axis of the first recess structure 212 to form an end of the first recess structure 212. The first end wall 216 may be configured to be in an abutting relationship with an end of the structural elements 190 when the structural elements 190 are fully inserted into the first recesses 212. The location of the first end wall 216 may determine the length of the

first recess 212, and thus the maximum length of the structural element 190 inserted into the first recess 212. The first end wall 216, together with a similar end wall 216 on a different connecting piece 186, may limit and/or prevent the movements of the structural elements 190 along their longitudinal axes when the bottom frame 164 is assembled to the luggage case 100.

[0076] The second recess structure 214 may further include a second retention end or a second end wall 218 arranged at an end of the second recess structure 214 that is configured to prevent the structural elements 188 from extending beyond the outer perimeter of the connecting pieces 186 that are near the front/rear panel 104, 106 of the luggage case 100. The second end wall 218 may be arranged at any location along the second axis of the second recess structure 214 to form an end of the second recess structure 214. The second end wall 218 may be configured to be in an abutting relationship with an end of the structural elements 188 when the structural elements 188 are operably coupled to the connecting pieces 186. The location of the second end wall 218 may determine the length of the second recess structure 214, and thus the maximum length of the structural element 188 inserted into the second recess structure 214. The second end wall 218, together with a similar second end wall 218 on a different connecting piece 186, may limit and/or prevent the movements of the structural elements 188 along their longitudinal axes when the bottom frame 164 is assembled to the luggage case 100.

[0077] Note that in some examples, the first end wall 216 and/or the second end wall 218 may completely or partially close the recess structure 212, 214. In some examples, the first end wall 216 and/or the second end wall 218 may form an inward lip or flange, or any suitable retention structure, extending from a portion or the entirety of a peripheral edge, or from any location at the inner periphery, of the recess structure 212, 214, and forming a partially or entirely open end of the recess structure 212, 214. Additionally and optionally, an abutment structure, an obstruction, an internal protrusion or any suitable retention structure may be positioned within the recess structure 212, 214 to contact the structural element 188, 190 at its end or outer surface and limits its insertion into the recess structure 212, 214.

[0078] The bottom frame 164 may be assembled by inserting the structural elements 188, 190 into the recess structures 212, 214 of the connecting pieces 186. In one example, no additional adhesive required. As described earlier with reference to Fig. 3, the bottom frame 164 may then be placed inside the luggage case 100 to be assembled to the bottom panel 110 of the luggage case 100. Since structural elements 188, 190 are flexible, some movement, such as rotation, twisting, bending of the structural elements 188, 190 within the recess structures 212, 214 and resilient bending of the bottom frame 164 may be allowed thereby making the positioning of the bottom frame 164 into the luggage case 100 and fitting it to the bottom panel 110 of the luggage case 100 easier.

[0079] Once the bottom frame 164 is assembled to the bottom panel 110 of the luggage case 100 and the connecting pieces 186 are connected to the wheel assemblies 116 with the structural sheet 170 and the bottom panel 110 of the luggage case 100 sandwiched there between, the movement of the structural elements 188, 190, especially movements in a direction along the longitudinal axes thereof, may be further limited by the front, rear, left and right side panels 104, 106, 112, 114 of the luggage case 100. In some examples, some movements of the structural elements 188, 190 relative to the connecting pieces 186 may still be allowed. Such movements may help absorb shock or impact upon the wheel assemblies 116 and reduce shock or impact transferred to the other parts of the luggage case 100. In addition, the structural elements 188, 190 may bend or flex upon impact thereby further absorbing and/or reducing shock or impact transferred from the wheel assembly 116. Accordingly, the bottom frame 164 may act like a suspension to the luggage case 100 to protect the structures of the luggage case 100 from damages that may be caused by excess forces exerted thereto.

[0080] In continuing reference to Figs. 3, 4, 5, and 8A-D, the structural elements 188, 190 or the extensions thereof received within the first and second recesses 212, 214 may cross each other. An extension of a structural element 188, 190 used herein may refer to a portion of the structural element 188, 190, or the entirety of the structural element 188, 190, or a portion extending beyond an end of the actual structural element 188, 190 along the longitudinal axis of the structural element 188, 190. Depending on the locations at which the first and second end walls 216, 218 may be formed along the respective axes of the first and second recess structures 212, 214, the first and second recess structures 212, 214 may extend across different portions of the connecting pieces 186 along a length dimension and a width dimension thereof. Accordingly, the structural elements 188, 190 may extend across different portions of the connecting pieces 186. In some examples, the relatively longer structural elements 190 may extend at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of the length dimension of the connecting pieces 186. In some examples, the relatively shorter structural elements 188 may extend at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of the width dimension of the connecting pieces 186. With structural elements 188, 190 extending further across the connecting pieces 186, improved stability of the luggage case 100 may be achieved. It should be noted that different percentage, other than listed above, may be implemented.

[0081] In addition to position the end walls 216, 218 at various locations along the respective axes of the first and second recess structures 212, 214, the first and second recess structures 212, 214 may be formed at various locations at the connecting pieces 186. The first recess structure 212 may be formed at any location closer to the

converging edge 210 and further away from the outer perimeter wall 204 opposing the converging edge 210, or vice versa, or along the center line there between. The second recess structure 214 may be formed at any location closer to the outer perimeter wall 206 near a side panel 112, 114 of the luggage case 100 and further away from an opposing outer perimeter wall 202 thereof, or vice versa, or along the center line there between.

[0082] With reference to Figs. 3 and 8A-D, and 9A, the closer the first recess structure 212 is located to the converging edge 210 of the connecting piece 186, and/or the closer the second recess structure 214 is located to the outer perimeter wall 206 near a side panel 112, 114 of the luggage case 100, a relatively large supported area 192 may be formed by the four structural elements 188, 190 when operably coupled to the connecting pieces 186 and assembled in the luggage case 100.

[0083] Referring still to Figs. 8A-8D, the first and second recesses 212, 214 of each corner plate may be preferably positioned to extend along the corner plate 186 so as to divide the connecting piece 186 into relatively small areas, such as the four quadrants 220, 222, 224, 226. The first and second recesses 212 and 214 may extend along lines parallel to the center line of each respective corner plate, which in some examples is parallel to the peripheral edges 111 and 113 of the bottom panel 110 of the luggage case.

[0084] These four quadrants 220, 222, 224, and 226 may be similarly sized, the same size, or different sizes. In the example shown in Fig. 8A-D, the second recess 214 extends along the length dimension from perimeter wall 204 to converging edge or wall 210 and divides the corner piece into an upper portion and a lower portion. The first recess 212 extends along a line orthogonal to the extension of the second recess 214, and is offset towards the converging wall 210. In combination, the first 212 and second 214 recesses divide the corner piece into four sections or quadrants 220, 222, 224, and 226. Quadrants 224 and 226 are larger than quadrants 220 and 222. Quadrant 226 is larger than quadrant 224, and quadrant 222 is larger than quadrant 220. With the recesses 212 and 214 formed centrally on the corner pieces, the four quadrants are relatively small and provide desired support. Dividing the connecting pieces 186 into quadrants 220, 222, 224, 226 with similar sizes may help to distribute the weight of the items inside the luggage compartment onto the connecting pieces 186 through the structural elements 188, 190 in a more even manner and avoid flexing an undesirable amount when the wheel attached to the corner piece impacts an object. If the recesses 212 and 214 are positioned closer to the wall 202 and converging wall 210 (Fig. 8A), the quadrant 224 may become relatively larger than the other quadrants, and thus be more susceptible to undesired flexing when loaded by the adjacent wheel impacting an object during use, or when the luggage case is heavily packed. Dividing the connecting pieces 186 into quadrants 220, 222, 224, 226 with similar sizes effectively reduces any undesirable

effect that may be caused by a combination of much bigger divided areas and much smaller divided areas. In one example, the recesses 212 and 214 are located on the corner plate 186 in a manner intended to minimize the size of the quadrants 220, 222, 224, and 226.

[0085] In continuing reference to Figs. 3 and 8A-D, and 9A, within each divided area or quadrant 220, 222, 224, 226, an aperture 194 may be formed to allow a fastener 196 to pass through to join the connecting pieces 186, thereby joining the bottom frame 164 to the bottom panel 110 of the luggage case 100 and to the wheel assemblies 116 or supporting feet below. Forming apertures 194 within each divided area 220, 222, 224, 226 thereby including the intersections of two structural elements 188, 190 within an area defined by the apertures 194, may transfer and/or distribute the support from the wheel assemblies 116 of the luggage case 100 in a more even manner onto the connecting pieces 186, and further onto the structural elements 188, 190, thereby allowing a more balanced support by the bottom frame 164 for the luggage case 100.

[0086] As best shown in Figs. 8A, 8C, and 9A, the smaller divided areas 220, 222, 224, 226 may each have a generally upward facing surface 228, 230, 232, 234, and the generally upward facing surfaces 228, 230, 232, 234 may be configured in the same plane or in different planes. The divided areas 224, 226 further away from the converging edge 210 may have generally upward facing surfaces 232, 234 configured to be lower than the generally upward facing surfaces 228, 230 of the two divided areas 220, 222 near the converging edge 210. Accordingly, a substantial or entire portion of the first recess 212 may be positioned between the generally upward facing surfaces 228, 230 and the bottom side 200 of the connecting pieces 186, or even between the generally upward facing surfaces 232, 234 and the bottom side 200, whereas a substantial or entire portion of the second recess 214 may be positioned above the generally upward facing surfaces 232, 234. Forming the generally upward facing surfaces 228, 230, 232, 234 of the divided areas 220, 222, 224, 226 at different planes may allow less material to be used forming the connecting piece 186 thereby reducing the overall weight of the bottom frame 164.

[0087] In continuing reference to Figs. 8A-D, the structures of the first and second recesses 212, 214 will be described in more detail. The first recess structure 212 may include a plurality of upper arched structures 240 and a plurality of lower arched structures 242. The plurality of the upper arched structures 240 and/or the plurality of the lower arched structures 242 may be spaced apart along a depth dimension or the axis of the first recess structure 212. The plurality of the upper arched structures 240 and the plurality of the lower arched structures 242 collectively define a recess configured to receive a structural element 190 therein. Each of the plurality of the upper arched structures 240 may include a generally downward or inward facing surface 244 that

generally conforms to a portion of an outer surface of the structural element 190, and a generally upward or outward facing surface 246 substantially parallel to the generally downward or inward facing surface 244. Alternatively, the generally upward or outward facing surface 246 may be formed independent of the shape of the generally downward or inward facing surface 244. Each of the plurality of the upper arched structures 240 may include a pair of side surfaces 252 that define a width of the upper arched structures 240. The plurality of the upper arched structures 240 may be formed with the same, different or varying widths. Similarly, each of the plurality of the lower arched structures 242 may include a generally upward or inward facing surface 248 that generally conforms to a different portion of the outer surface of the structural element 190, and a generally downward or outward facing surface 250. The generally downward or outward facing surfaces 250 of the lower arched structures 242 may form portions of the bottom side 200 of the connecting pieces 186 which conform to the shape of the luggage panel portion under the connecting pieces 186. Each of the plurality of the lower arched structures 242 may include a pair of side surfaces 254 that define a width of the lower arched structures 242. Each of the plurality of the lower arched structures 242 may be formed with the same, different or varying widths.

[0088] The plurality of the upper arched structures 240 and the plurality of the lower arched structures 242 may collectively define the recess 212 with their respective inward facing surfaces 244, 248 configured to generally conform to portions of the outer surface of the structural element 190 received within the recess 212, thereby holding by a friction-fit the structural element 190 in place and limiting the movements of the structural element 190 within the recess 212. The structural elements 190 may be additionally or optionally held in place by fasteners, adhesive, set screws and so on.

[0089] As better illustrated in Figs 8C and 8D, the plurality of the upper arched structures 240 and the plurality of the lower arched structures 242 may be formed in an alternating manner thereby not overlapping with each other when viewed from the top and/or the bottom of the connecting pieces 186. This non-overlapping arrangement may allow the connecting pieces 186 and the upper and lower arched structures 240, 242 thereof to be formed in one molding step without any slides for the molding process. It should be noted that in some examples, the plurality of the upper arched structures 240 and the plurality of the lower arched structures 242 may be configured with portions of each other overlapping when viewed from the top or bottom. In some examples, the plurality of the upper arched structures 240 may be formed as a single continuous arched structure. In some examples, the plurality of the lower arched structure 242 may be formed as a single continuous arched structure.

[0090] Similar to the first recess structure 212, the second recess structure 214 may include a plurality of upper arched structures 256 and a plurality of lower arched

structures 258, similar to those arched structures 240, 242 of the first recess structure 212, for receiving an end of another structural element 188 therein. The plurality of the upper arched structures 256 of the second recess structure 214 and/or the plurality of the lower arched structures 258 of the second recess structure 214 may be respectively formed as a single continuous upper arched structure and/or a single continuous lower arched structure.

[0091] As best illustrated in Figs. 9B and 9C, the generally downward or inward facing surfaces 244 of the upper arched structures 240 of the first recess structure 212 may be configured to be not higher than the generally upward or inward facing surfaces 260 of the lower arched structures 258 of the second recess structure 214 along a dimension perpendicular to the axes of the first and second recess structures 212, 214. Such configuration may allow a structural element 190 coupled to the first recess structure 212 of the connecting piece 186 to touch or to be positioned slightly below a structural element 188 coupled to the second recess structure 214 of the same connecting piece 186. Accordingly, the longitudinal axis of the structural element 190 coupled to the first recess structure 212 of the connecting piece 186 may be spaced apart from the longitudinal axis of the structural element 188 coupled to the second recess structure 214 of the same connecting piece 186 along a dimension perpendicular to the respective longitudinal axes or the respective length dimensions of the two structural elements 188, 190. Such configuration may act to limit and/or prevent the interference between the structure elements 188, 190 coupled the connecting pieces 186.

[0092] Please note that although arched segments or arched structures 240, 242, 256, 258 are described herein as examples, the first and/or second recess structures 212, 214 may be made of a combination of arched segments or continuous or solid wall or wall segments. In some examples, the upper portion of the recess structure 212, 214 may be made of a plurality of arched segments 240, 256 while the lower portion of the recess structure 212, 214 may be made of a continuous solid wall, or vice versa. In some examples, both the upper and lower portions of the recess structure 212, 214 may be made of continuous solid walls as described below.

[0093] With reference to Figs. 4, 5, 8B and 8D, the bottom side 200 of the connecting pieces 186 will be described in more detail. As best shown in Figs. 5 and 10B, the bottom side 200 of the connecting pieces 186 may have a profile generally conforming to shape of the luggage portion there under and generally conforming to the upper profile of an outer housing 134 of the wheel assembly 116. The bottom side 200 of the connecting pieces 186 may include multiple internal side walls 262 inside the outer perimeter walls 202, 204, 206. The outer perimeter walls 202, 204, 206 and/or the internal walls 262 may be formed with a thickness of 2 to 3 millimeters or any other suitable thickness to provide desired structural strength and rigidity. The internal side walls 262 and/or

portions of the outer perimeter wall 206 may define a plurality of receptacles 264 for receiving the screw bosses or threaded posts 162 of the outer wheel housing 134 of the wheel assembly 116. The receptacles 264 defined thereof may help align the connecting pieces 186 with the corresponding outer wheel housings 134. The bottom side 200 of the connecting pieces 186 may also include internal side walls 266 extending downward from the plurality of the lower arched structures 260 of the second recess structure 214. The internal side walls 262, 266 on the bottom side 200 of the connecting pieces 186 may collectively form a honeycomb-like structure and provide additional structural rigidity to the connecting pieces 186.

[0094] Although only one connecting piece 186 is described herein in detail, it would be apparent to one with ordinary skills in the art as to the structures of the other connecting pieces 186, since they may be formed of the same or a symmetric structure. Further, the connecting pieces 186 may have the same or similar top side features, but different bottom side features to accommodate different structures attached thereto, such as different wheel assemblies or supporting feet/studs attached to the bottom panel 110 of a luggage case 100.

[0095] It should be noted that while four structural elements 188, 190 are shown here with each arranged between two connecting pieces 186, and extending near an edge of the bottom panel 110, it is contemplated that two or more structural elements may be arranged between two connecting pieces 186, and that different numbers of structural elements may be arranged near different edges of the bottom panel 110 for additional structural support. For example, without limitation, a relative large luggage case 100 may benefit from a bottom frame 164 with multiple structural elements 190 arranged near the longer edge of the bottom panel 110 of the luggage case 100, and/or multiple structural elements 188 arranged near the shorter edge of the bottom panel 110 of the luggage case 100. The structural element may be arranged diagonally between two connecting pieces 186 if desired. Further, the connecting pieces 186 may be formed of any suitable shape, including top or bottom curves or curvilinear perimeter shapes, a rectangular shape when viewed from the top. While the first and second axes of the first and second recess structures 212, 214 of each connecting pieces 186 are described as perpendicular to each other, they can be configured at any angle with respect to each other to accommodate different angles defined by the structural elements 188, 190. In addition, more recess structures may be formed in each connecting piece 186 for receiving more structural elements 188, 190. The connecting pieces 186 may be formed using acrylonitrile butadiene styrene (ABS), polypropylene (PP), polyamide or any other suitable material. The connecting pieces 186 described herein may be formed by molding with or without mold slides, or any other suitable method.

[0096] The structural elements 188, 190 may be made of fiber reinforced polymer materials, such as fiberglass,

metal, or any other suitable material. The structural elements 188, 190 may be formed by extrusion and cut into any appropriate length. By simply using structural elements 188, 190 with different lengths, the dimension of the bottom frame 164 can easily be adjusted or changed without having to use different connecting pieces 186. This would allow a more streamlined manufacturing process with less or no adjustment to the manufacturing equipment for creating different bottom frames 164 to fit in luggage pieces 100 of different sizes. Furthermore, the connecting pieces 186 and the structural elements 188, 190 may be formed with high precision and uniformity, leading to a leveled plane defined by the bottom frame 164 when assembled, and further leading to a leveled support by the wheel assemblies 116 joined thereto.

[0097] Fig. 10A is a schematic rear elevation view of the left bottom corner of the luggage case 100 incorporating the bottom frame 164 described herein. Fig. 10B is a schematic cross section view of the portion of the luggage case 100 shown in Fig. 10A, viewed along line 10B-10B in Fig. 10A. The connecting pieces 186 may be joined to the wheel housings 134 as described above with reference to Figs. 3-5 so as to join the bottom frame 164 to the bottom panel 110 of the luggage case 100. When joined to the bottom panel 110, the outer cover 168 of the luggage case 100 may be sandwiched between the connecting pieces 186 and the outer wheel housings 134 such that the bottom frame 164 may be positioned within an enclosed space, such as a main compartment 102 as defined by the panels 104, 106, 108, 110, 112, 114 of the luggage case 100. In some examples, the structural sheet 170 and/or other layers if desired may be sandwiched between the connecting pieces 186 and outer wheel housings 134. In some examples, the outer cover 168 may be the only layer sandwiched between the connecting pieces 186 and the outer wheel housings 134. The luggage case 100 may include an inner lining 166 covering the bottom frame 164. Outside the luggage case 100, the yoke mount 150 and the outer wheel housing 134 may be rotatably coupled to each other through an axle, a shaft or any suitable fastener 154. A wheel 152 may be positioned between two arms 156 at the lower portion of the yoke mount 150 and rotatably coupled to the two arms 156 by a wheel core 158 and a central axle 160.

[0098] With reference to Fig. 11, one advantageous feature of the frame assembly 164 for attaching the wheel assemblies 116 to the bottom panel 110 of the luggage case 100 allows some additional flexibility in the placement of the wheel assemblies 116 relative to the corners of the luggage case 100 to improve stability. The location of the apertures 194 formed in the connecting pieces 186 may be shifted toward the converging edge 210 and/or outer perimeter wall 206 of the connecting pieces 186 near the side panels 112, 114. These alternative locations of the apertures 194' formed in the connecting piece 186' may allow the wheel assembly 116 joined thereto to shift outward toward the edges 268, 270 of the bottom

panel 110 of the luggage case 100. All four wheel assemblies 116, or fewer than all, may be shifted outward toward the edges 268, 270 of the bottom panel 110 of the luggage case 100. In some examples, the two front wheel assemblies 116 (i.e., the two wheel assemblies 116 near the front panel 104 of the luggage case 100) may be shifted while the two rear wheel assemblies 116 (i.e., the two wheel assemblies 116 near the rear panel 106 of the luggage case 100) may not be shifted, or vice versa. Accordingly, the apertures 194' formed in the connecting pieces 186' near the front panel 104 of the luggage case 100 may be formed closer to the converging edge 210 and/or the outer perimeter wall 206 of the connecting pieces 186', hence closer to the front and/or side edges of the bottom panel 110, and the apertures 194 formed in the connecting pieces 186 near the rear panel 106 of the luggage case 100 may be formed less close to the rear and/or side edges of the bottom panel 110, or vice versa. The apertures 194' may be shifted towards both the converging edge 210 and the outer perimeter wall 206 near the side panel 112, 114. The apertures 194' may be shifted toward only the converging edge 210 or toward only the outer perimeter wall 206 near the side panel 112, 114. Accordingly, the wheel assemblies 116 may be shift outward toward the front and/or back edge of the bottom panel 110, and may still remain within the left and/or right edges of the bottom panel 110 of the luggage case 100. The four or less shifted wheel assemblies 116' may collectively define a larger supported area by the wheel assemblies 116', thereby increasing the stability of the luggage case 100. Further, the shifted wheel assemblies 116' leading to an increased support area may not result in an increase in the overall dimension of the luggage case 100, especially in the case where only the front wheel assemblies 116' are shifted since the shifted wheel assemblies 116' may still remain behind the front panel 104 of the luggage case 100.

[0099] With reference to Figs. 12A, 12B, 13 and 14, another example of a connecting piece (or corner plate) 300 that can be used to form a bottom frame 302 will be described. The connecting piece 300 may include a base plate 304, a first recess structure 306, a second recess structure 308 and a plurality of receptacles 310 formed on the base plate 304.

[0100] The base plate 304 may generally define a rectilinear shape and may be divided into a curved upper section 312 and a lower section 314 by the first recess structure 306. The curved upper section 312 may generally conform to the shape of the edge portions between the front/back panel 104, 106 and the bottom panel 110 and the upper profile of an outer wheel housing attached thereto. The curved upper section 312 may extend, in general, tangentially from an underside 316 of the first recess structure 306 towards a front/rear panel 104, 106. The lower section 314 of the base plate 304 may be divided into a first lower subsection 318 and a second lower subsection 320 by an outer diameter wall 322 of the second recess structure 308, which forms an underside of

the second recess structure 308. In some examples, the first lower subsection 318 and the second lower subsection 320 may be formed as one continuous piece and extend tangentially from the outer diameter wall 322 of the second recess structure 308. Since the first and second recess structures 306, 308 may be positioned in different vertical planes as described below, the curved upper section 312 and the lower section 314 may form a vertical step 324 as best illustrated in Fig. 12B, with the curved upper section 312 in an abutting relationship with the bottom panel 110 and/or the structural sheet 170 when incorporated to the luggage case 100. The stepped construction allows less material to be used, resulting in a lightweight connecting piece 300. The curved upper section 312 and the lower section 314 may be formed as thin pieces/plates to further reduce the weight of the connecting piece 300.

[0101] The base plate 304 may further include a first lip 326 extending upward from an edge of the curved upper section 312, the first lip 326 being in an abutting relationship with the side panel 112, 114 of the luggage case 100 when the bottom frame 302 is incorporated to the luggage case 100. The first lip 326 may extend lengthwise continuously through to the lower section 314, and may define a curved outer surface 346 to promote a smooth contact between the corner plate 300 and the abutting left/right side panel 112, 114. A vertical wall 328 (Fig. 12B) may be formed joining the bottom edge 330 of the first lip 326 and the adjacent edge 322 of the lower section 314 for better structural stability. An edge of the curved upper section 312 opposing the edge joined to the first lip 326 may be formed with a second lip 338 to provide a smooth contact with the adjacent bottom luggage panel 110.

[0102] In continuing reference to Figs. 12A, 12B, the first and second recess structures 306, 308, each configured to receive a structural element 188, 190 to form a bottom frame 302, may be substantially perpendicular to each other. The first and second recess structures 306, 308 may be positioned in different vertical planes (with respect to the lower section 314 of the base plate 304) such that the first and the second recess structures 306, 308 or extensions thereof, as well as the structural elements 188, 190 received therein, may cross or overlap each other and may be orthogonally oriented.

[0103] In contrast to the connecting piece 186 shown in Fig. 8A where the first and second recesses 212, 214 are formed with a plurality of arched segments, each of the first and second recesses 306, 308 of the connecting piece 300 shown in Figs. 12A and 12B may be formed as tubular structures with continuous or solid tube walls 340, 342 extending between an open end 344, 346 and a retention end 348, 350 for molding simplicity and strength. The extension between the open end 344, 346 and the retention end 348, 350 of the first and second recess structures 306, 308 may define a respective length dimension of the first and second recess structures 306, 308, which defines the length of the portion of

the respective structural elements 188, 190 received therein. The first and second recess structures 306, 308 may extend at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of respective length and width dimensions of the connecting pieces 300. It should be noted that different percentage, other than as listed above, may be implemented. Also, it should be noted that the retention end of each recess structure may be closed, or may be entirely or partially open. Additionally, an abutment structure, an obstruction, an internal protrusion or any suitable retention structure may be positioned within the recess structure to contact the structural element and limit its insertion into the recess.

[0104] The first and second recess structures 306, 308 may be preferably configured to cross or overlap each other at a location generally corresponding to at or near a center of the base plate 304 such that the connecting piece 300 may be divided by the first and second recesses 306, 308 into four quadrants or corner areas that are similarly or equally sized. It is contemplated, however, that the first and second recess structures 306, 308 may overlap or cross each other at any location within an area defined by the base plate 304 for other considerations.

[0105] In further reference to Figs. 12A and 12B, the second recess structure 308 may be formed with uniform radial wall thickness. The first recess structure 306 may be formed with varying radial wall thickness, with the lower portion or the underside 316 of the first recess structure 306 thinner than the upper and/or side portions of the first recess structure 306 since the lower portion or the underside 316 of the first recess structure 306 may be in contact with, and supported by, the bottom panel 110 of the luggage case 100.

[0106] Referring to Figs. 12A, 12B and 13, the connecting piece 300 may include a plurality of receptacles 310 formed on the base plate 304 for receiving screw bosses or threaded posts of the particular outer wheel housing to which the connecting piece 300 may be attached. The plurality of receptacles 310 may be formed in general as boss structures protruding in a generally upward direction from the base plate 304 of the connecting piece 300. In some examples, the bosses positioned adjacent to the front/rear panel 106, 108 may protrude toward the inner compartment of the luggage case 100 at an angle of, for example, 45 degrees or any suitable angle, with respect to the lower section 314 of the base plate 304 for receiving a similarly angled screw bosses or threaded posts on the outer wheel housing. Each boss structure may include a truncated, and in this instance a flat top 352 and an oval wall 354 that positions the top 352 above the base plate 304. The top 352 may include an aperture 356 formed therein such that a fastener may be positioned through the aperture 356 and received in the screw bosses or thread posts on the outer wheel housing to attach the connecting piece 300 to the wheel assembly. The plurality of receptacles 310 may be positioned on the base plate 304 in a manner such that each

quadrant/corner area of the base plate 304 may include at least one receptacle 310 formed therein. To improve the strength of the receptacles 310, connecting walls 358, 360, 362, 364 may be formed between receptacles 310 within adjacent quadrants/corner areas.

[0107] With reference to Figs. 13 and 14, four structural elements 188, 190 may be inserted into respective first and second recess structures 306, 308 of four connecting pieces 300 to form a bottom frame 302. The structural elements 188, 190 may be held in place within the recesses 306, 308 by friction, and in some examples, additional adhesive or other mechanical fasteners may be used. A kick plate 366 may be joined to the bottom frame 302 by attaching the kick plate 366 to a middle portion of the structural element 190 adjacent to the rear panel 106 of the luggage case as described below. Accordingly, the kick plate 366 is mounted to the luggage case 100 between the rear panel 106 and the bottom panel 110, and on the side facing the direction the luggage case is pulled on its wheels. Attaching the kick plate 366 at a middle portion provides protection and stabilization upon impact and load when the luggage 100 is being angled and pulled.

[0108] The kick plate 366 may define in general an L shape including a base portion 368, a back portion 370, and a transition portion 372. The transition portion 372 may have openings 374 formed therein for an aesthetic appeal. The kick plate 366 may include screw bosses 376, 378 selectively positioned on the inner surface of the base and back portions 368, 370. Although not shown, apertures at locations corresponding to the locations of the screw bosses 376, 378 may be formed in the structural sheet 170 and the bottom and rear panels 110, 106 of the luggage case 100. The screw bosses 376, 378 may be positioned through the apertures in the luggage panels 106, 110 and the structural sheets 170 from the outside of the luggage case 100. Fasteners may be positioned through the apertures in the structural sheet 170 and luggage panels 106, 110 from inside of the luggage case 100 and received in the screw bosses 376, 378 to secure the kick plate 366 to the luggage case 100. The kick plate 366 may also include retaining structures 384 for receiving end portions of a telescoping handle.

[0109] To attach the bottom frame 302 to the kick plate 366, a holding structure or clip 390 including a boss portion 392 and an arch portion 394 may be used. The boss portion 392 may be placed over a middle screw boss 376 on the base portion 368 of the kick plate 366, and joined thereto by a fastener positioned through an aperture 398 formed in the top 396 of the boss portion 392. The arch portion 394 may define a concave surface that conforms to an outer surface of the structural element 190 and hold the structural element 190 in place. The holding structure 390 may preferably secure the structural element 190 in an abutting relationship with the screw bosses 376 on the base portion 368. Since the kick plate 366 is secured to the panels 106, 110 of the luggage case 100, holding a structural element 190 to the kick plate 366 may further

secure the bottom frame 302 and reduce any undesirable movement of the bottom frame 302 with respect to the luggage case 100. Although one holding structure 390 is described herein, more holding structures 390 and holding structures with different configurations may be utilized to secure the structural element 190 to the kick plate 366.

[0110] It should be noted that all directional references (e.g., upper, lower, upward, downward, left, right, leftward, rightward, top, bottom, above, below, front, back, rear, forward, backward, rearward, inner, outer, inward, outward, vertical, horizontal, clockwise, and counter-clockwise) are only used for identification purposes to aid the reader's understanding of the implementations of the present invention, and do not create limitations, particularly as to the position, orientation, or use of the invention unless specifically set forth in the claims.

[0111] Dimensional references (e.g., length, width, height, depth, relative orientation) are only used for identification purposes to aid the reader's understanding of the implementations of the present invention, and do not create limitations, particularly as to the relative size or geometry of the invention unless specifically set forth in the claims.

[0112] Connection references (e.g., attached, coupled, connected, joined, and the like) are to be construed broadly and may include intermediate members between a connection of elements and relative movement between elements. As such, connection references do not necessarily infer that two elements are directly connected and in a fixed relation to each other.

[0113] In some instances, components are described with reference to "ends" having a particular characteristic and/or being connected with another part. However, those skilled in the art will recognize that the present invention is not limited to components that terminate immediately beyond their points of connection with other parts. Thus, the term "end" should be interpreted broadly, in a manner that includes areas adjacent, rearward, forward of, or otherwise near the terminus of a particular element, link, component, part, member or the like. In methodologies directly or indirectly set forth herein, various steps and operations are described in one possible order of operation, but those skilled in the art will recognize that steps and operations may be rearranged, replaced, or eliminated without necessarily departing from the spirit and scope of the present invention. It is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative only and not limiting. Changes in detail or structure may be made that are within the scope of the appended claims.

Claims

1. A luggage case (100) having a bottom panel (110) including a frame (164), the frame (164) comprising:

at least one first plate (186);
 at least one first structural element (190) defining a first longitudinal axis and operably associated with the at least one first plate (186) and extending along a first dimension thereof;
 at least one second structural element (188) defining a second longitudinal axis and operably associated with the at least one first plate (186) and extending along a second dimension thereof;

characterised in that

the first longitudinal axis of the at least one first structural element (190) is spaced apart from the second longitudinal axis of the at least one second structural element (188) in a third dimension; and
 an extension of the at least one first structural element (190) crosses an extension of the at least one second structural element (188).

2. The luggage case (100) according to claim 1, wherein:

the at least one first plate (186) is arranged proximate to a first corner region of the bottom panel (110).

3. The luggage case (100) according to any of claims 1 and 2, wherein:

the at least one first plate (186) includes at least one first recess (212) and at least one second recess (214);
 the at least one first structural element (190) is operably associated with the at least one first recess (212); and
 the at least one second structural element (188) is operably associated with the at least one second recess (214).

4. The luggage case (100) according to claim 3, wherein:

the at least one first recess (212) and the at least one second recess (214) cross each other.

5. The luggage case (100) according to any of claims 3 and 4, wherein:

the at least one first and second recesses (212, 214) each includes an open end and a retention end (216, 218);
 a terminal end of the at least one first structural element (190) abuts the retention end (216, 348) of the at least one first recess (212); and
 a terminal end of the at least one second structural element (188) abuts the retention end (218) of the at least one second recess (214).

6. The luggage case (100) according to any of claims 3-5, wherein:

the at least one first and second recesses (212, 214) are configured such that the at least one first and second structural elements (188, 190) are movable along the first and second longitudinal axes, respectively, and/or rotatable within the at least one first and second recesses (212, 214), respectively.

7. The luggage case (100) according to any of claims 3-6, wherein:

the at least one first plate (186) includes at least one top surface (234) and at least one bottom surface (200);
 a substantial portion of the at least one first recess (212) is positioned between the at least one top surface (234) and the at least one bottom surface (200) along at least a portion of a length dimension of the at least one first plate (186); and
 a substantial portion of the at least one second recess (214) is positioned above the at least one top surface (234) along at least a portion of a width dimension of the at least one first plate (186).

8. The luggage case (100) according to any of claims 3-7, wherein:

the at least one first recess (212, 306) is defined at least in part by a plurality of arched segments (240, 242) and/or a continuous tubular structure (340).

9. The luggage case (100) according to any of claims 1-8, wherein

the at least one first structural element (190) extends across at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of a length dimension of the at least one first plate (186); and

the at least one second structural element (188) extends across at least 40%, preferably more than 50%, more preferably at least 75%, or substantially the entirety of a width dimension of the at least one first plate (186).

10. The luggage case (100) according to any of claims 1-9, further comprising:

a wheel assembly (116) operably coupled to the at least one first plate (186).

11. The luggage case (100) according to any of the claims 1-10, wherein:

the at least one first and second structural elements (188, 190) are flexible.

12. The luggage case (100) according to any of claims 1-11, wherein: 5

the at least one first and second structural elements (188, 190) are operably associated with the at least one first plate (186) before the frame (164) is operably associated with the bottom panel (110) of the luggage case (100). 10

13. The luggage case (100) according to any of claims 1-12, wherein: 15

at least one of the at least one first or second structural elements (188, 190) comprises a hollow center along the longitudinal axis thereof.

14. The luggage case (100) according to any of claims 1-13, wherein: 20

the at least one first structural element (190) and the at least one second structural element (188) divide the at least one first plate (186) into four quadrants (220, 222, 224, 226). 25

15. The luggage case (100) according to claim 14, wherein: 30

the size of each of the quadrants (220, 222, 224, 226) is minimized.

35

40

45

50

55

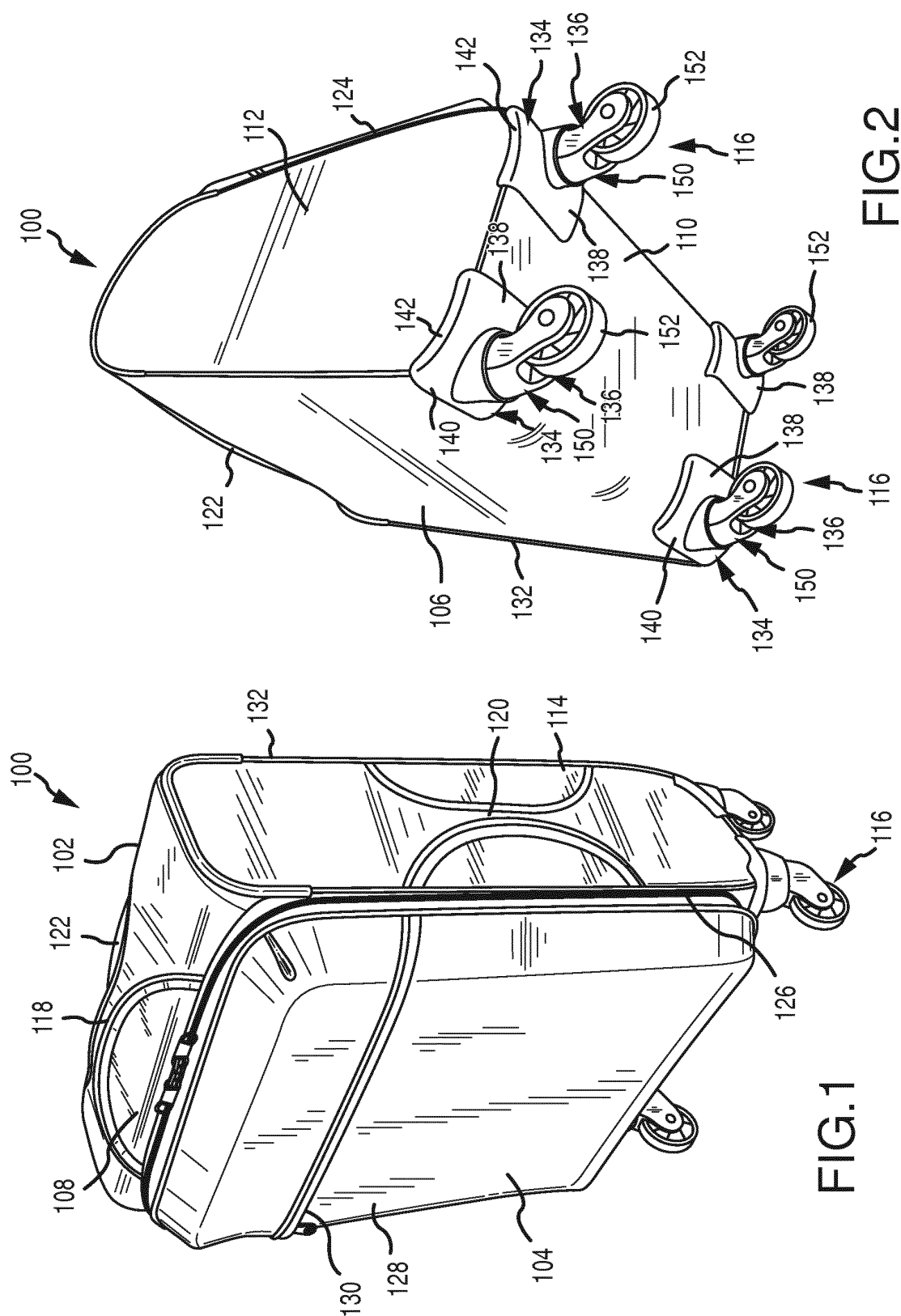


FIG.2

FIG.1

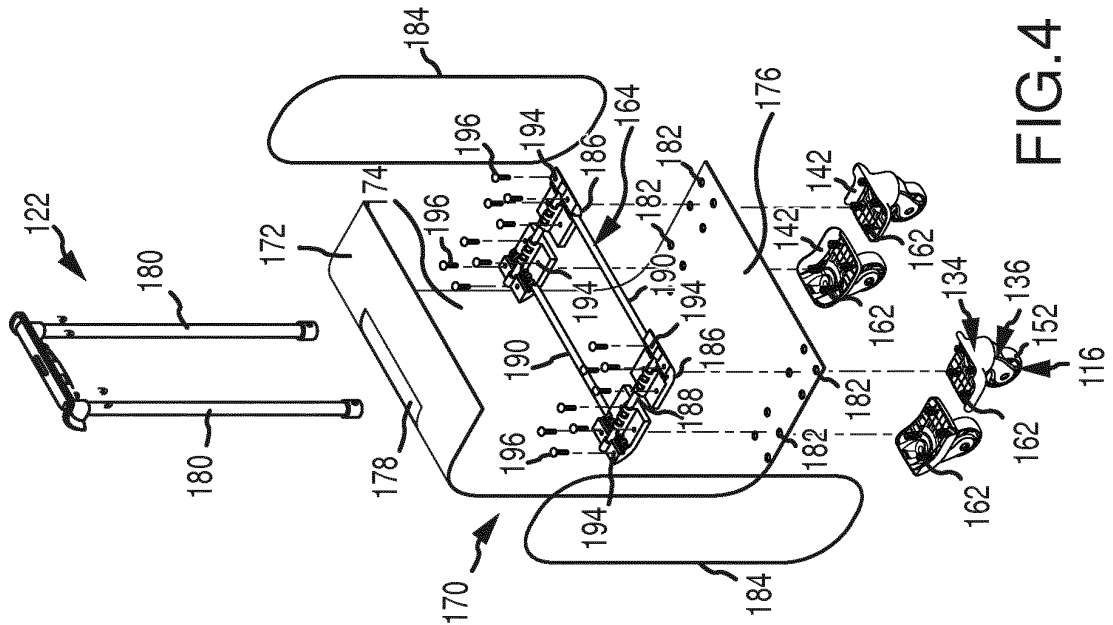


FIG. 4

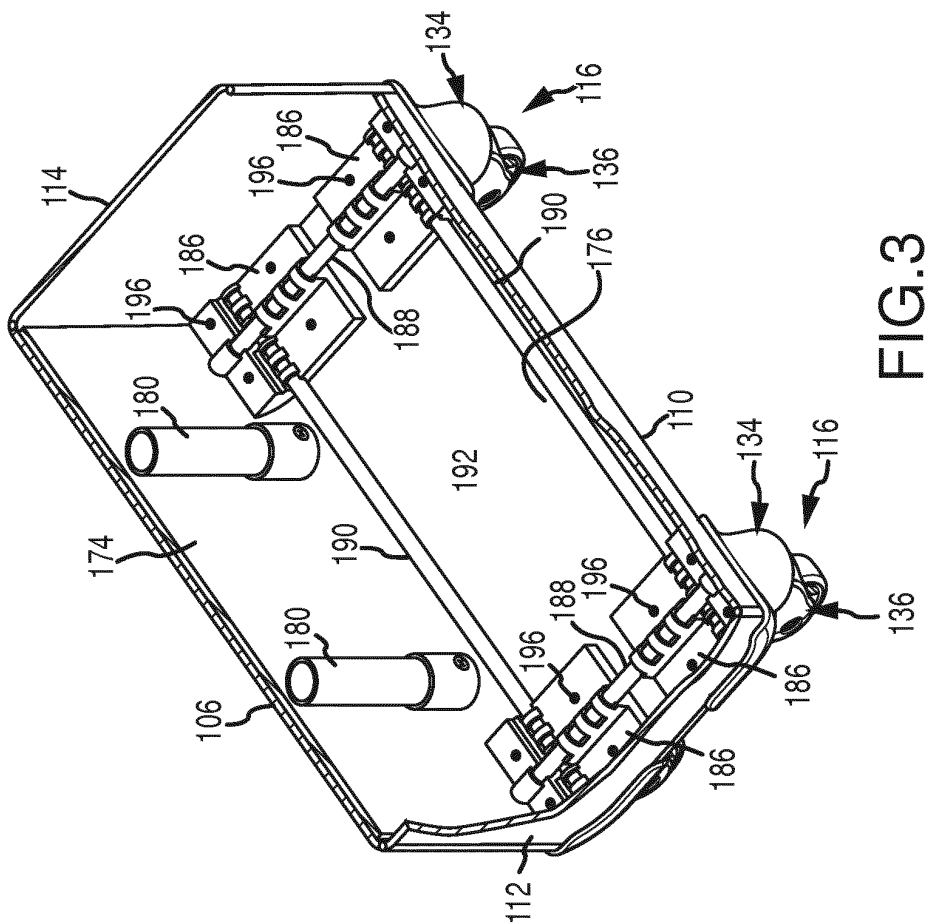
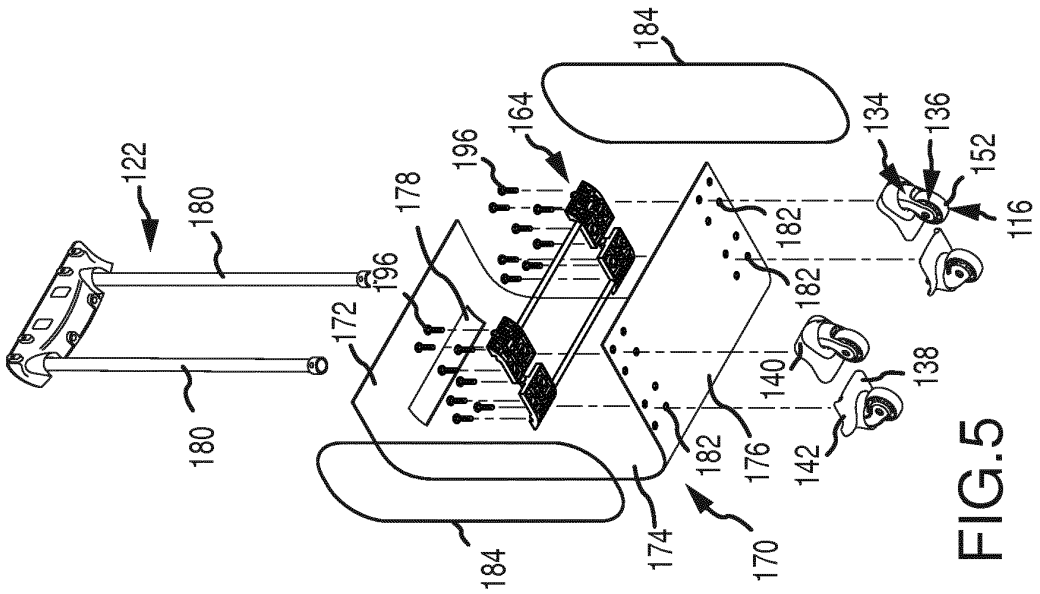
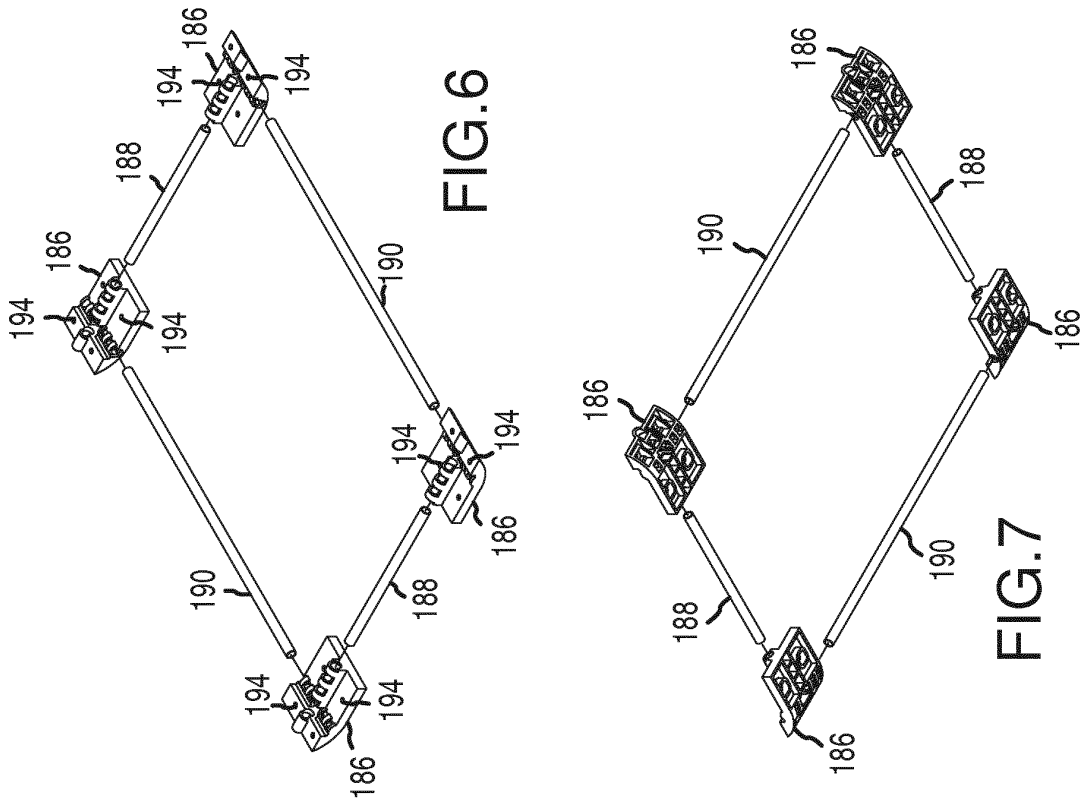


FIG. 3



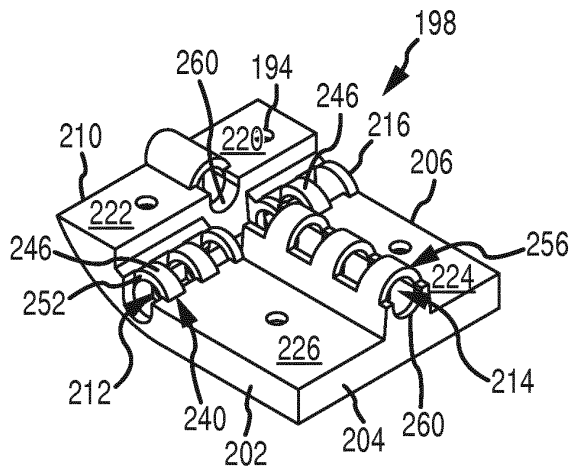


FIG. 8A

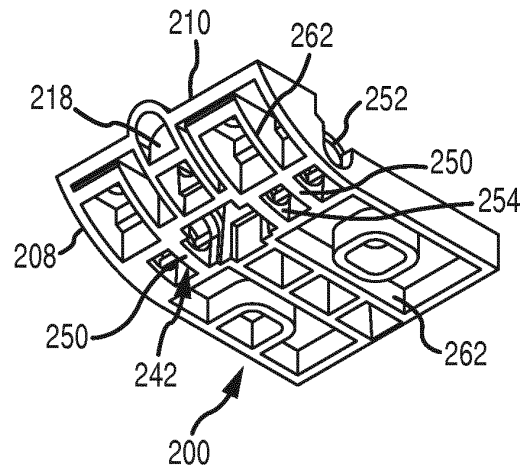


FIG. 8B

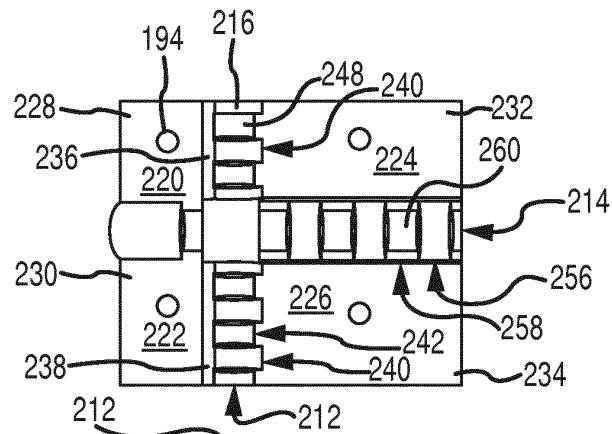


FIG. 8C

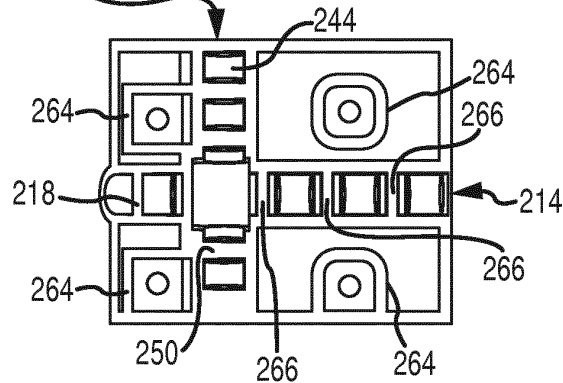


FIG. 8D

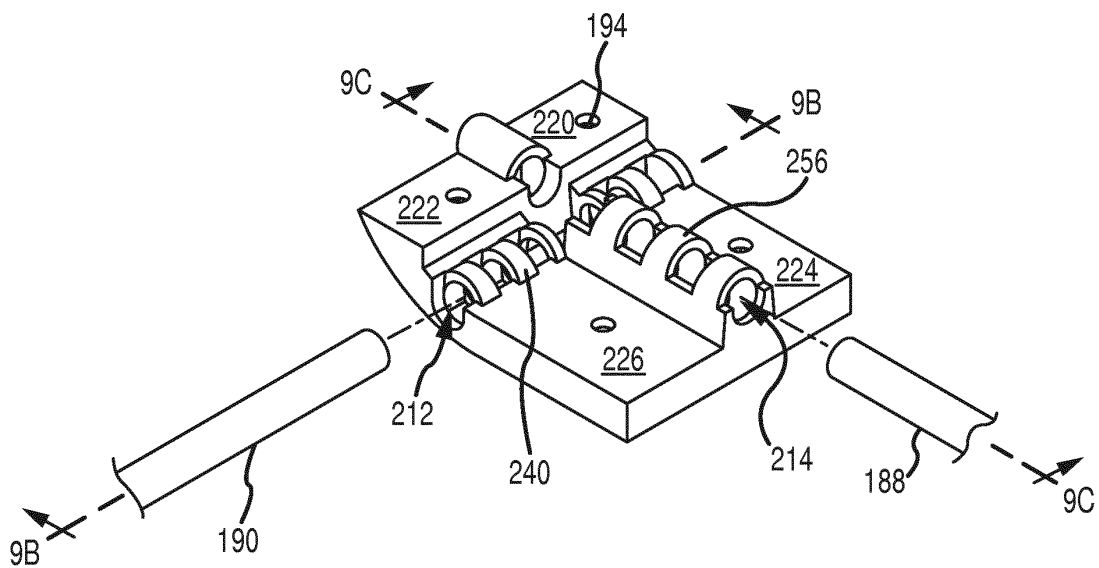


FIG. 9A

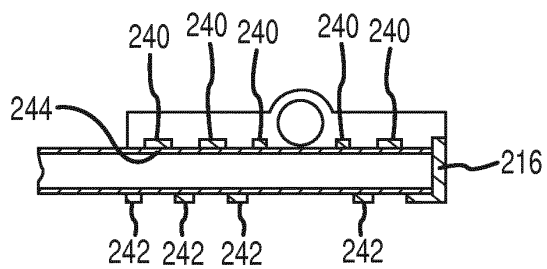


FIG. 9B

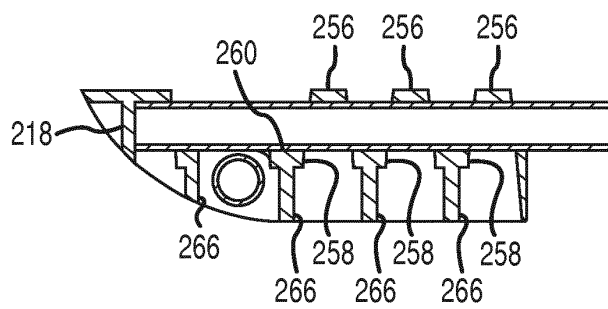
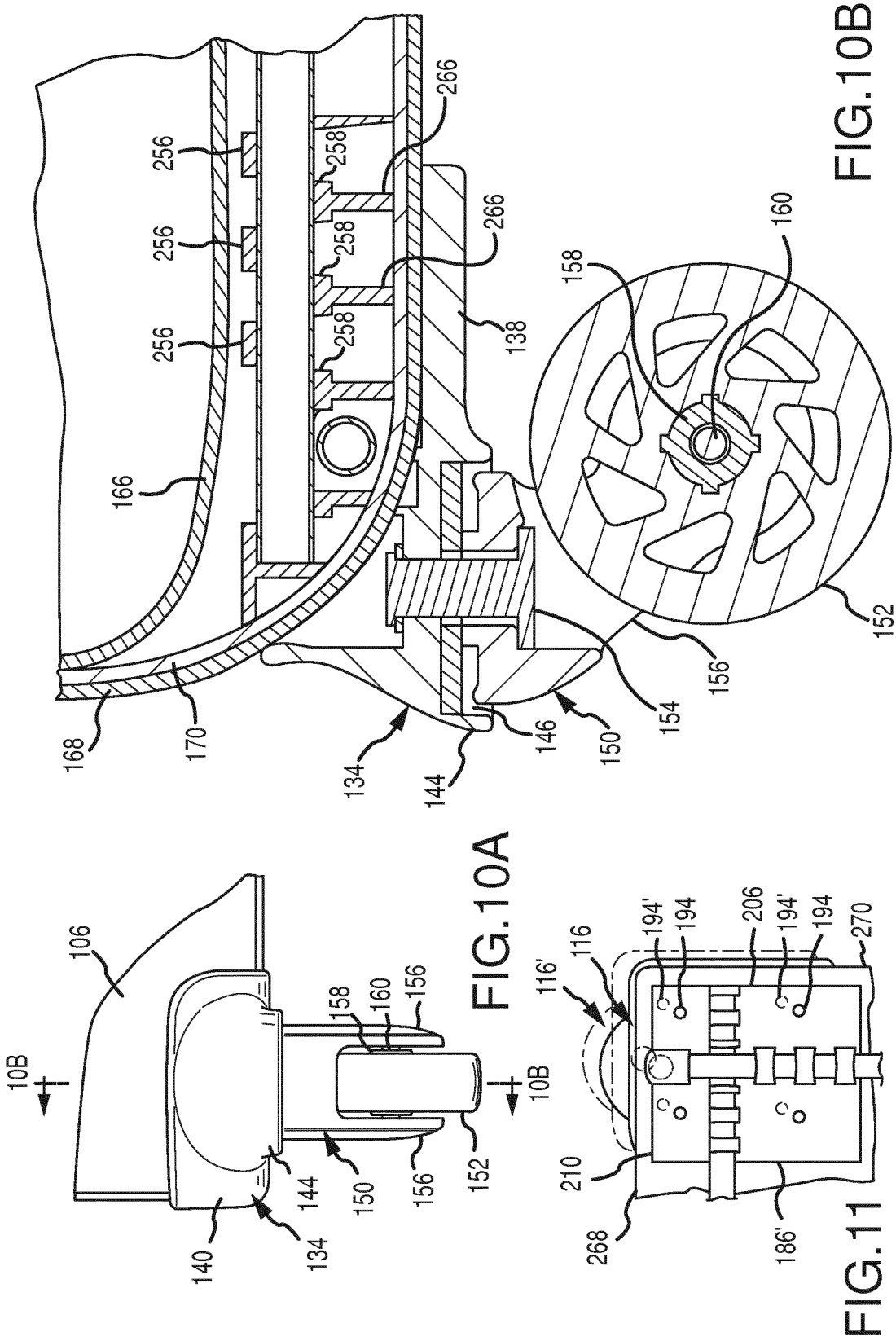
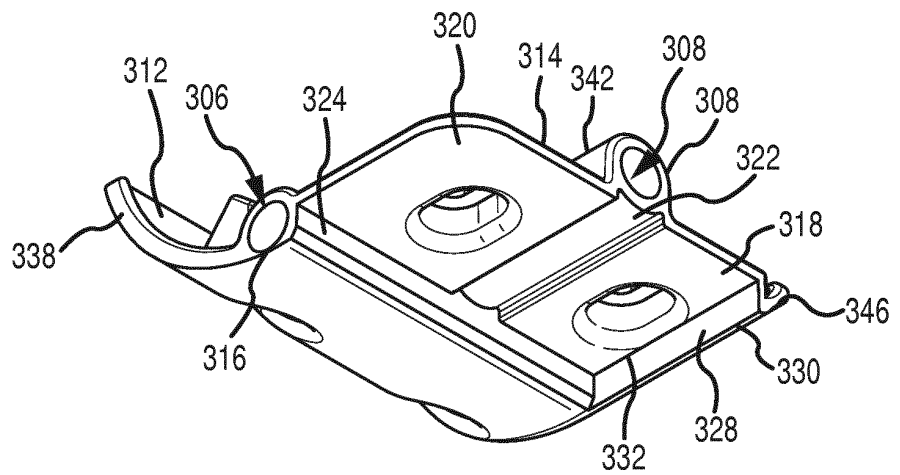
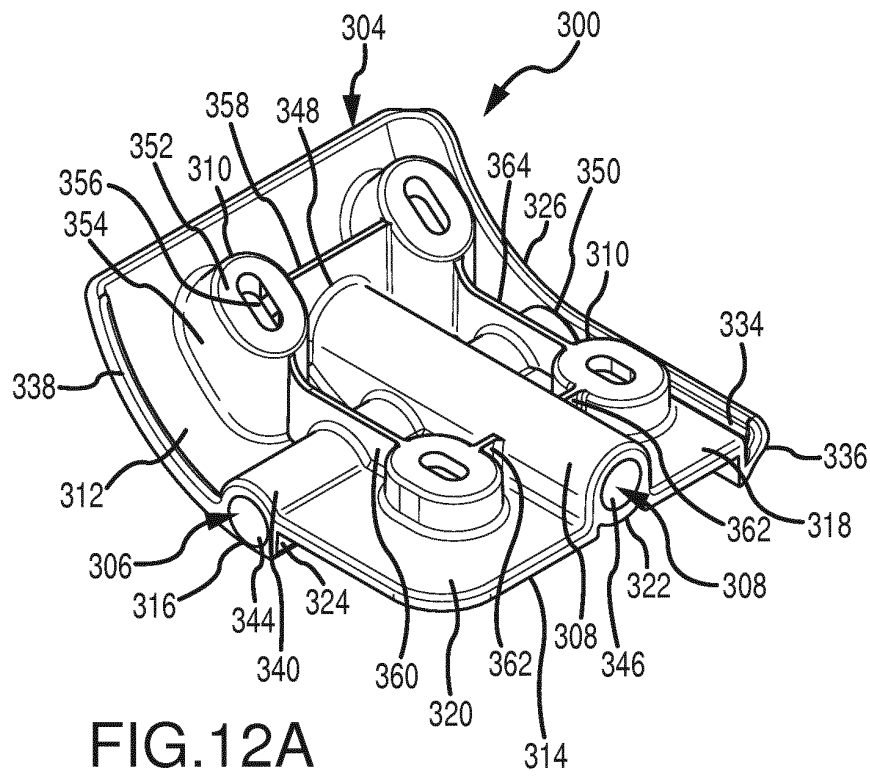


FIG. 9C





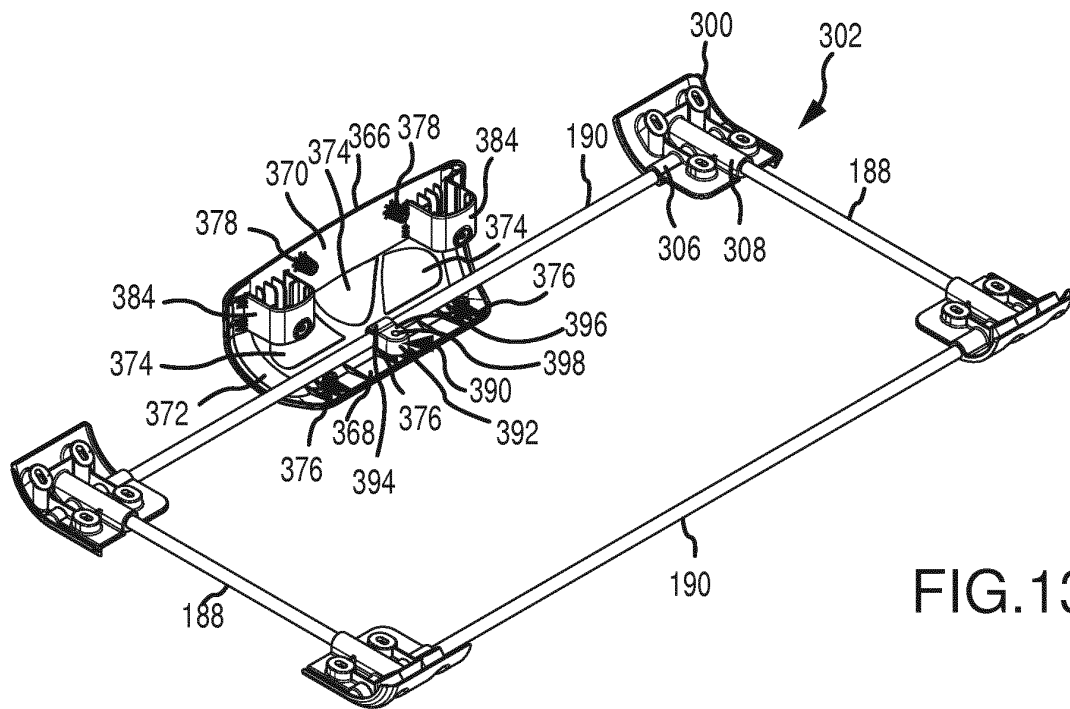


FIG. 13

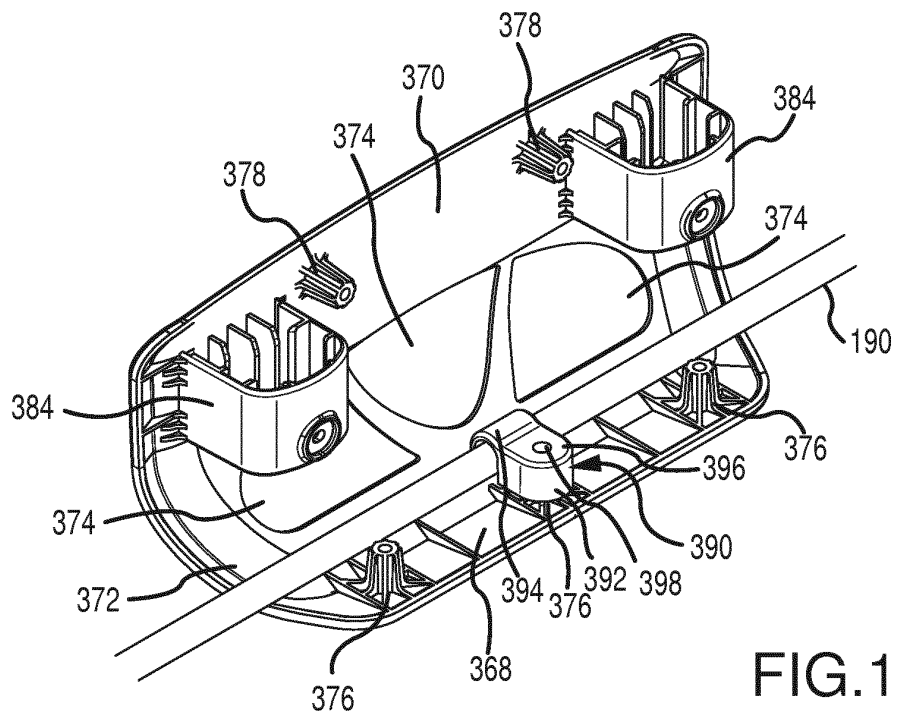


FIG. 14



EUROPEAN SEARCH REPORT

Application Number
EP 12 19 2397

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	US 2002/125665 A1 (COHEN FRED [US]) 12 September 2002 (2002-09-12) * paragraphs [0020], [0023], [0027]; figures 1-6 *	1-15	INV. A45C5/14 A45C13/04 A45C13/36
X	US 2006/118376 A1 (GODSHAW DONALD E [US] ET AL) 8 June 2006 (2006-06-08) * figures 5,10-14 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A45C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 April 2013	Examiner Oliveras, Mariana
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			

1

EPO FORM 1503 03.82 (P04C01)

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

EP 12 19 2397

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-04-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002125665 A1	12-09-2002	NONE	

US 2006118376 A1	08-06-2006	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2363037 A [0005]
- GB 2477087 A [0005]
- GB 2441580 A [0005]
- GB 2440206 A [0005]
- GB 2361692 A [0005]
- US 7984797 B [0005]
- US 7896143 B [0005]
- US 6131713 A [0005]
- US 4813520 A [0005]
- US 2008245633 A [0005]
- US 2006180422 A [0005]
- US 2003034215 A [0005]
- US 2003019705 A [0005]
- US 2002024189 A [0005]
- US 2002125665 A [0005]
- CN 201234670 [0005]
- CN 201234669 [0005]