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(54) **SUITCASE WITH RETRACTABLE WHEELS**

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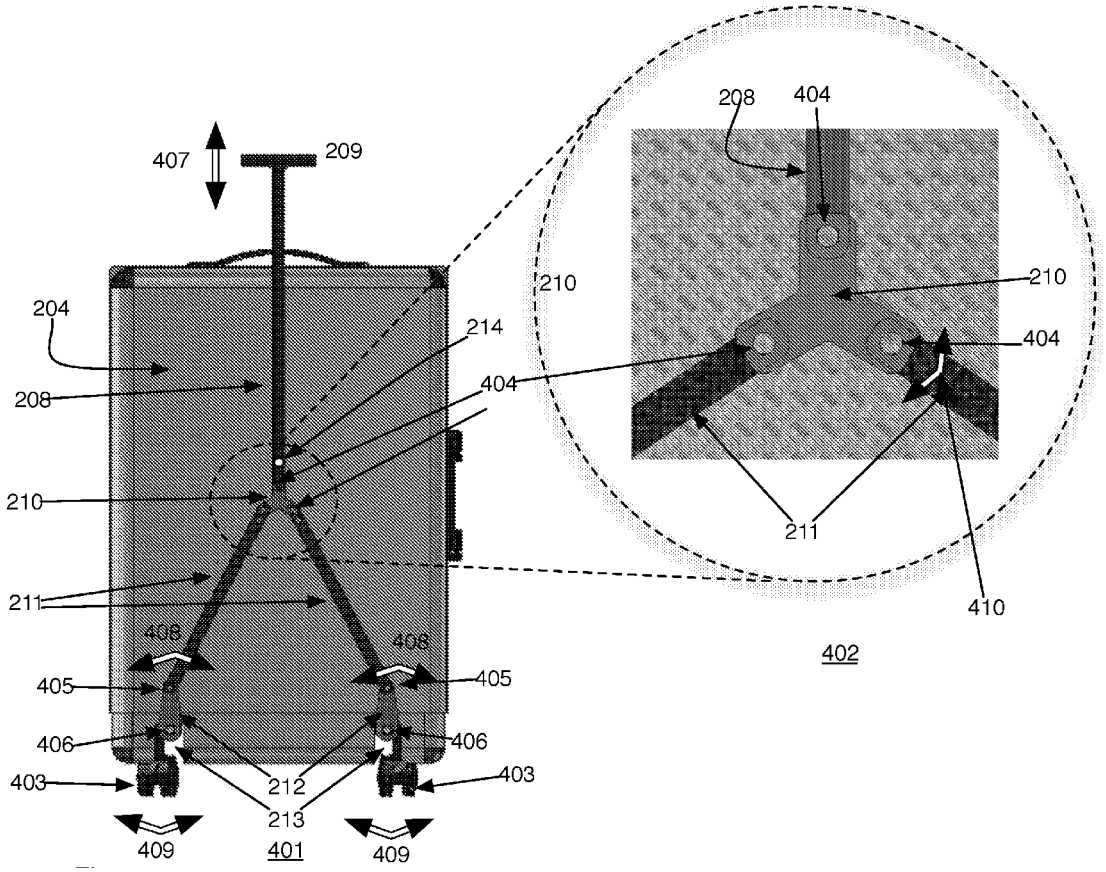
(57) **ABSTRACT**

A suitcase with retractable wheels is described. A linkage provides a means to raise and lower wheels either by a vertical motion or a folding motion such that the wheels may be extended for rolling the suitcase when the use is walking and the wheels may be retracted for easy stowage of the suitcase such as in a luggage compartment. The linkage may be attached to the back of the suitcase, located in the interior of the suitcase or enclosed in a shell that is attached to the back of the suitcase.



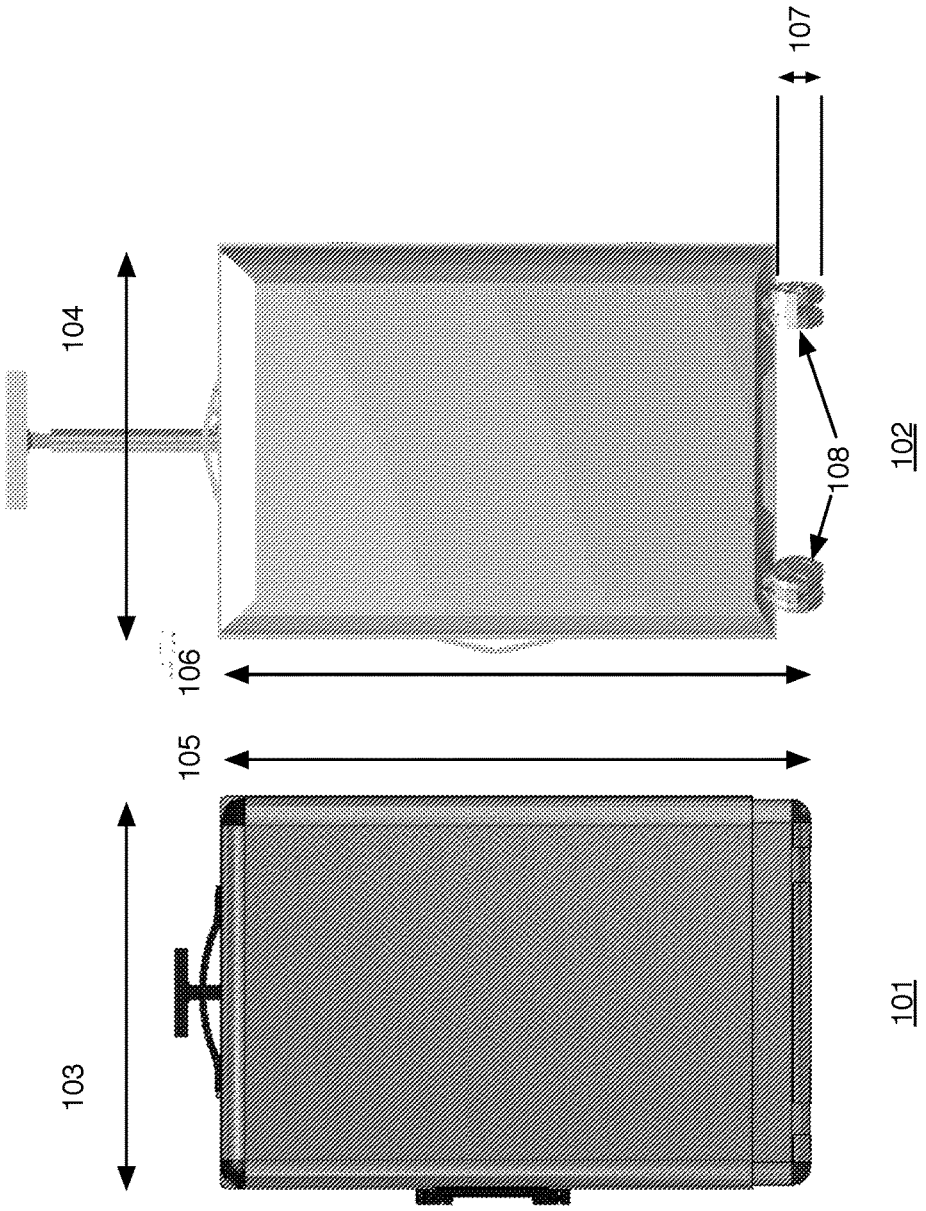


Figure 1

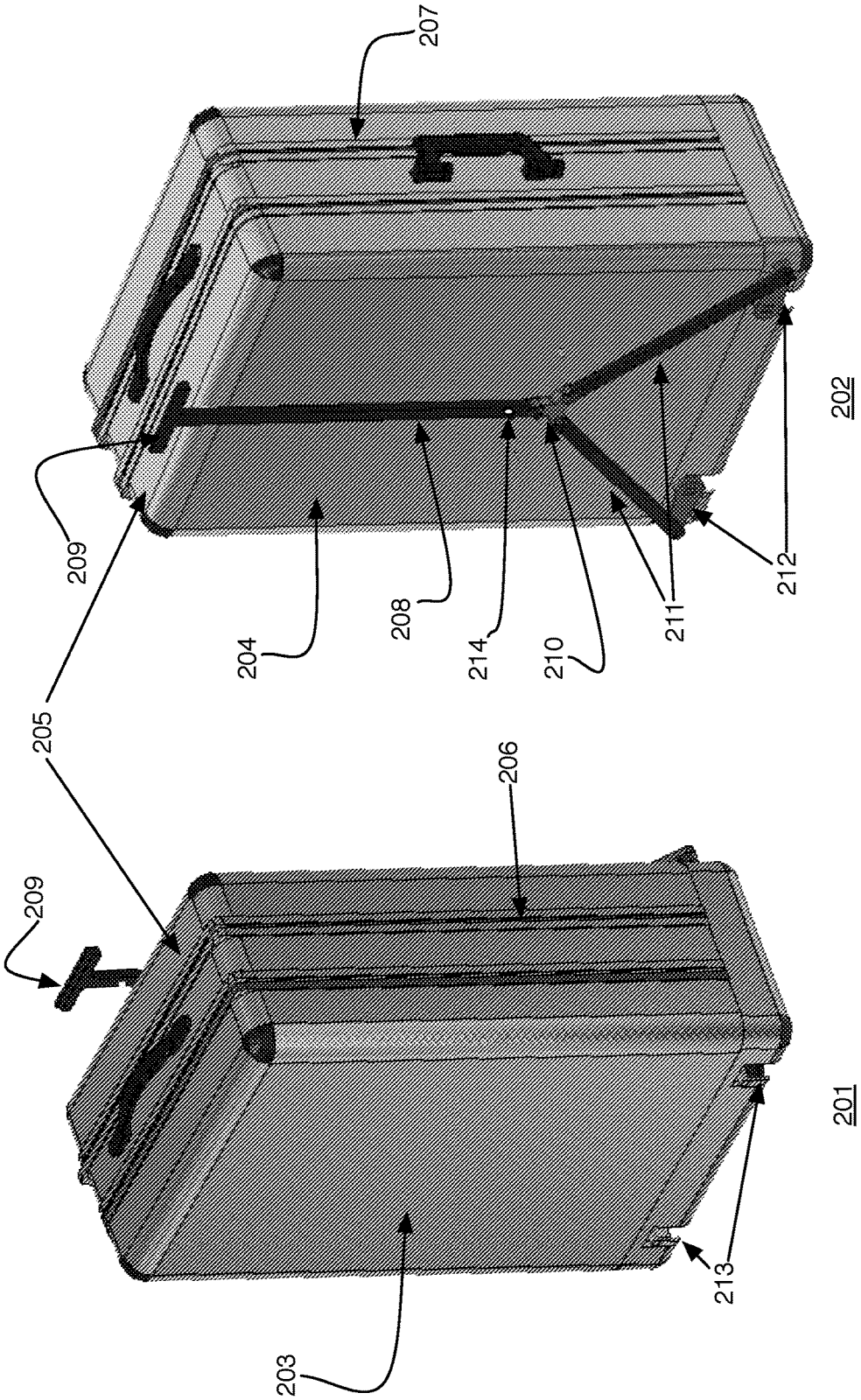
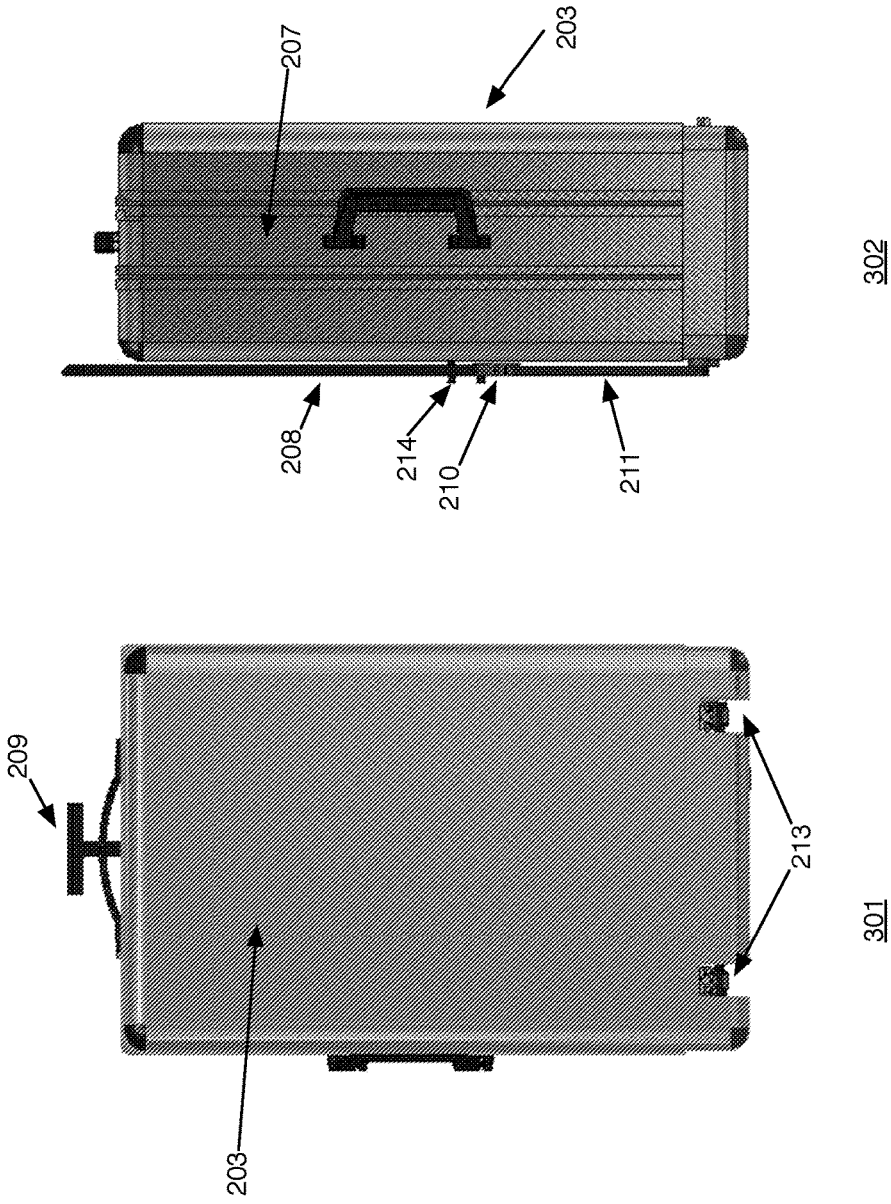


Figure 2



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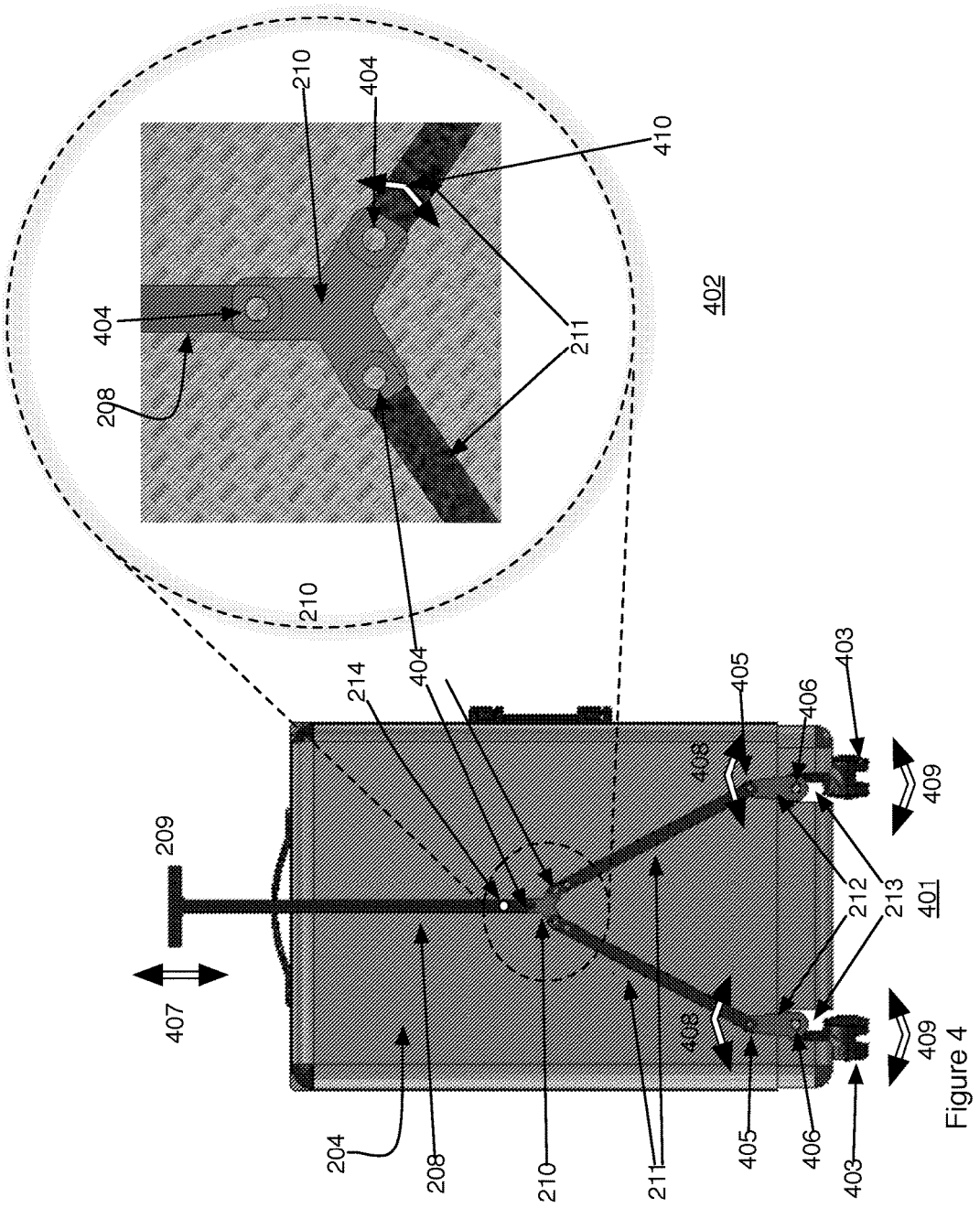
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Figure 4

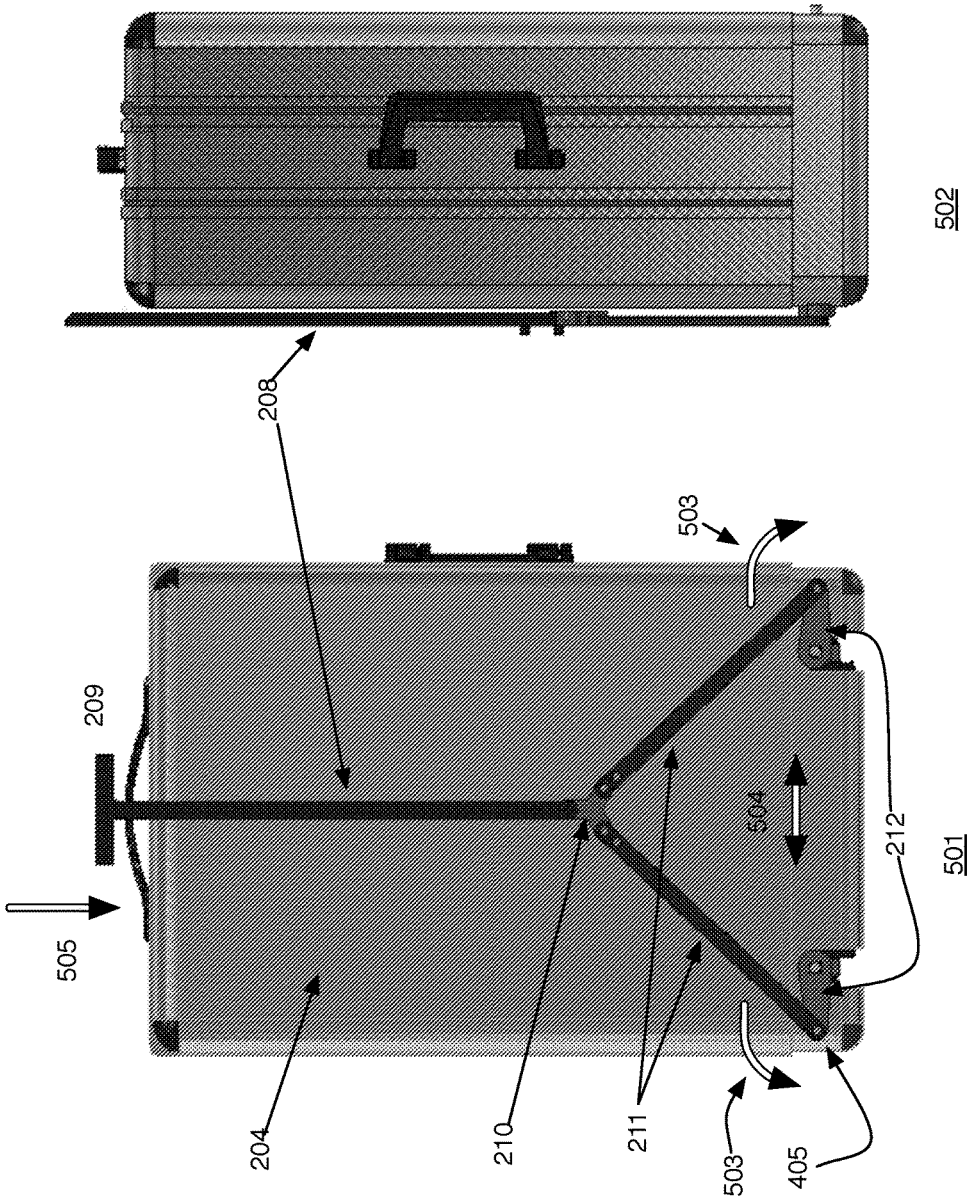

Figure 5

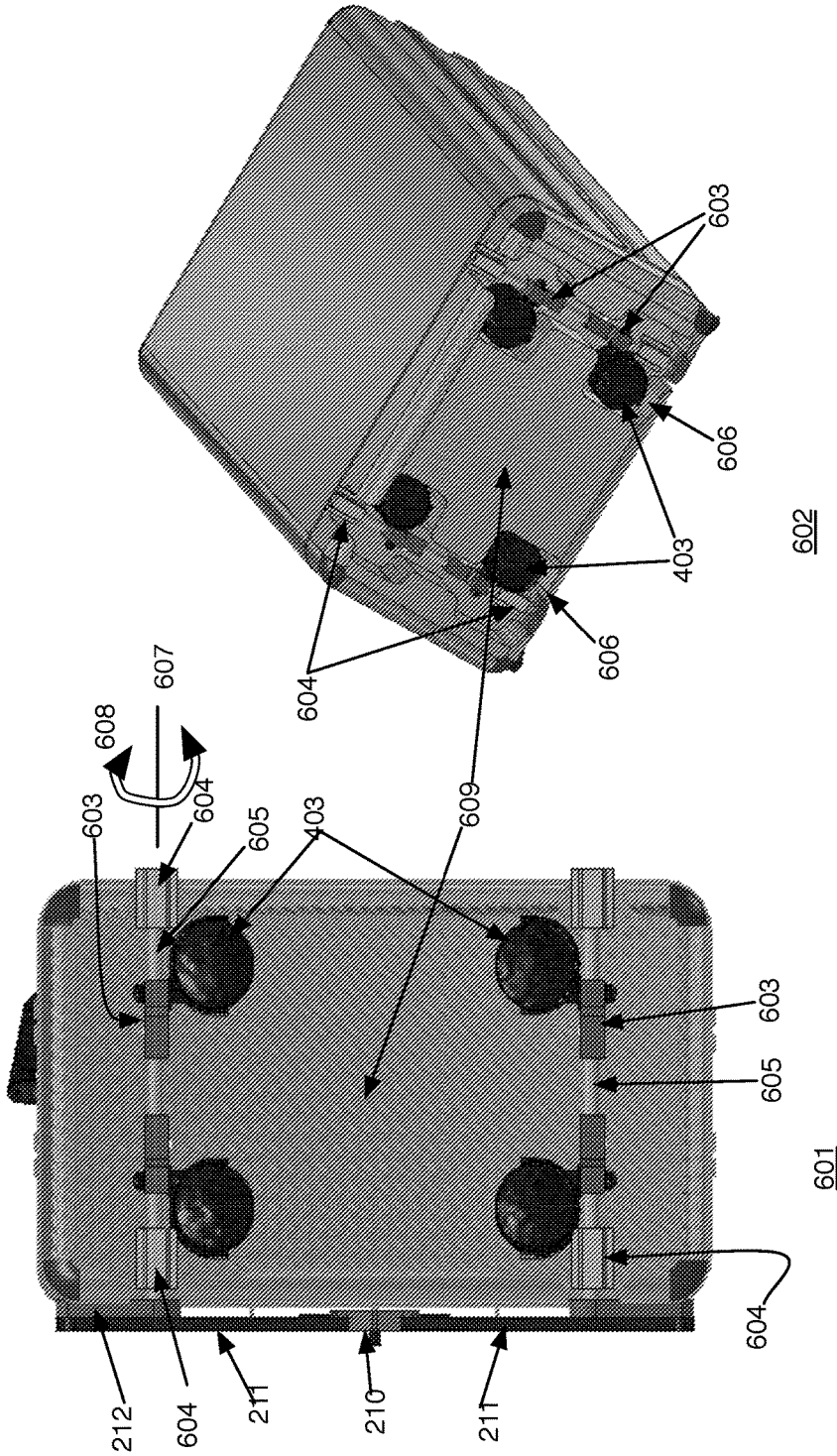
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Figure 6

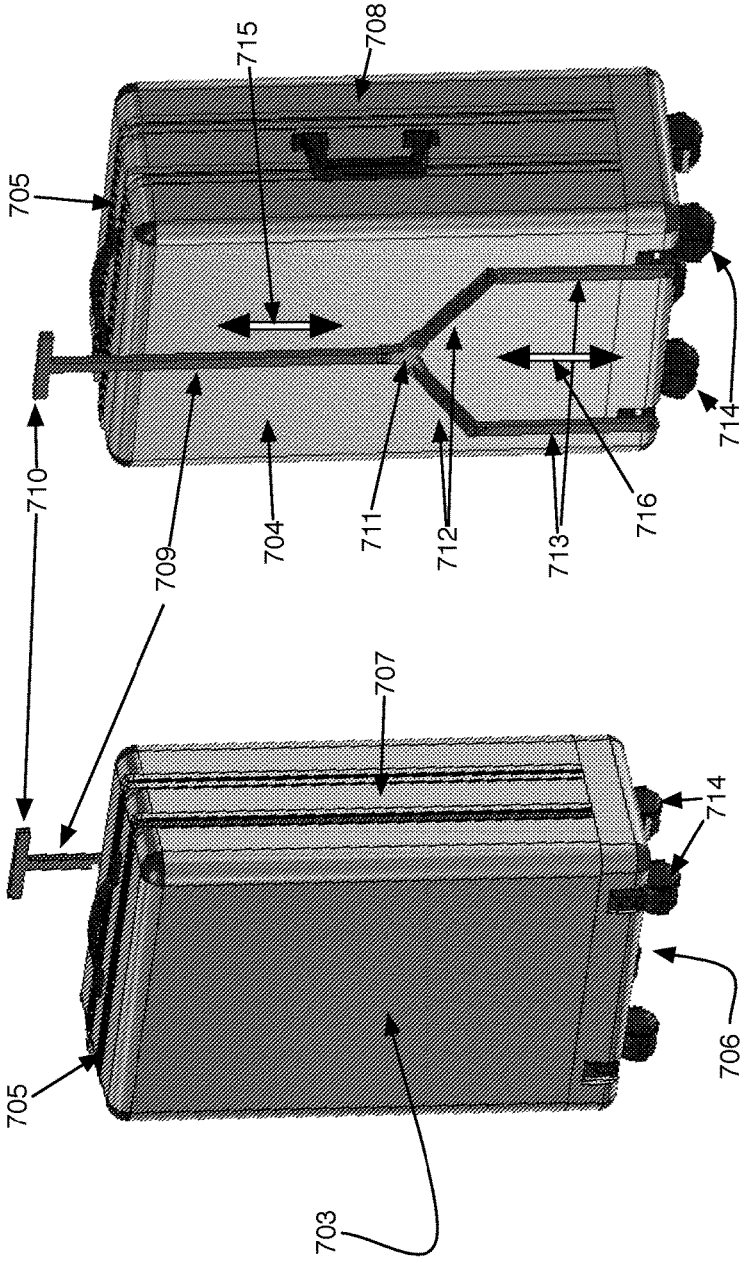
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Figure 7

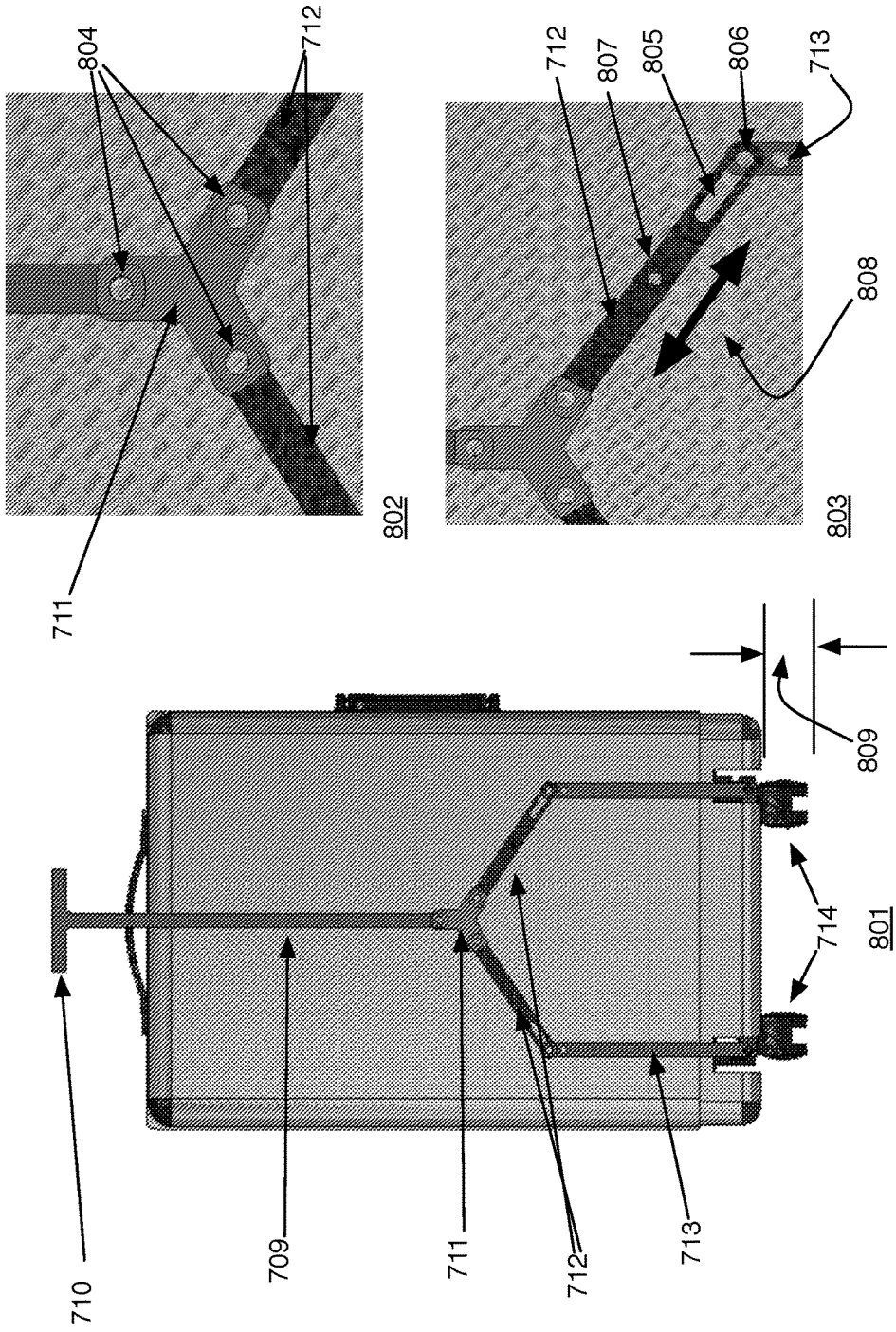
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Figure 8

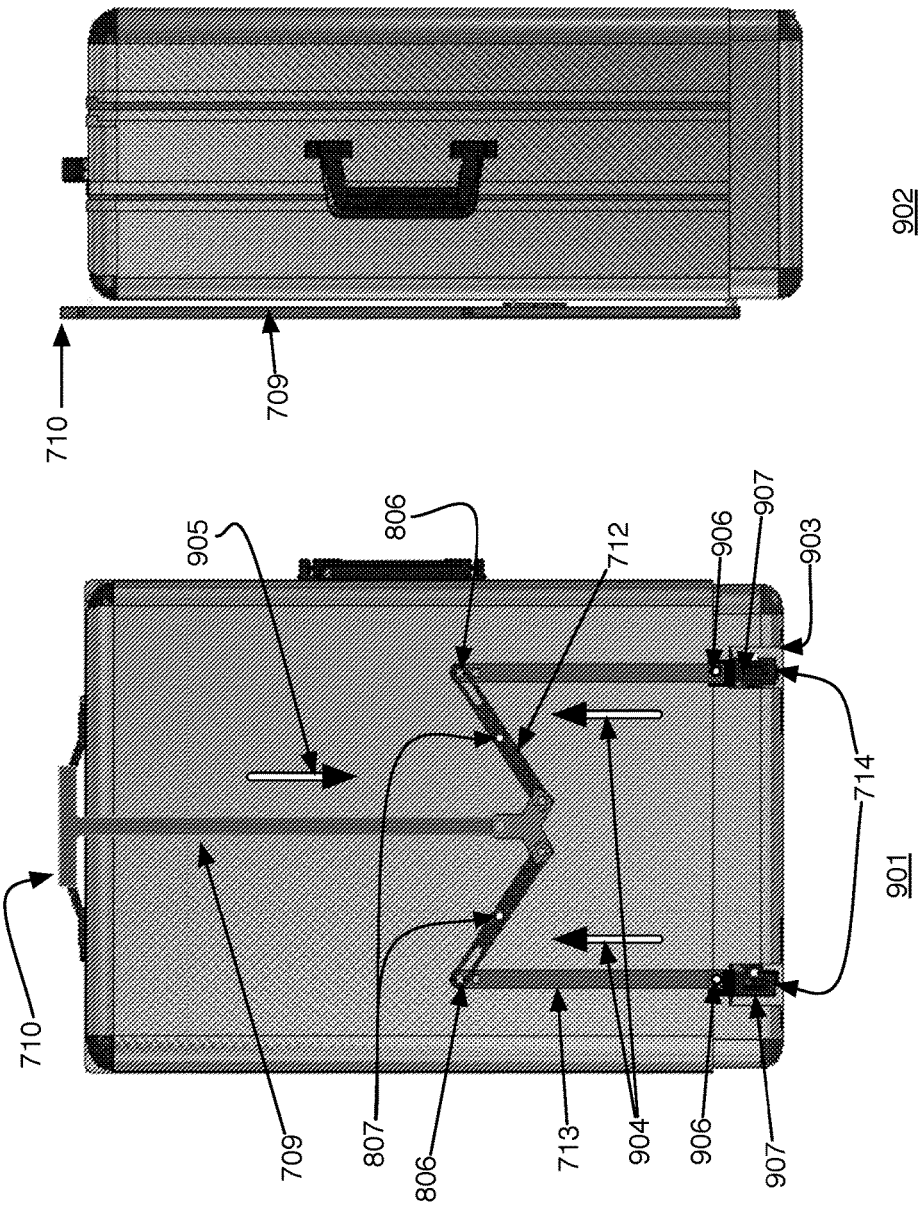
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Figure 9

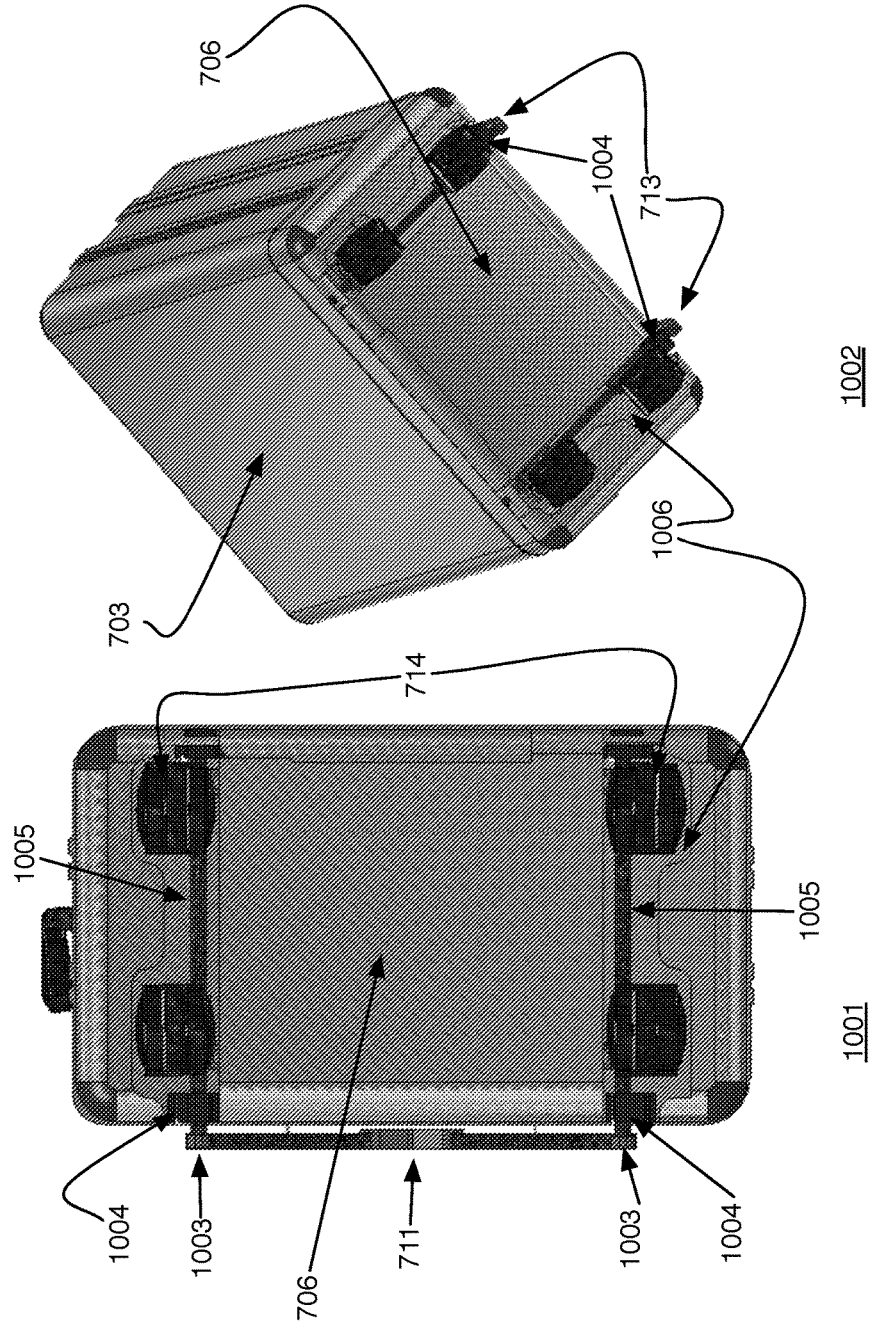
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Figure 10

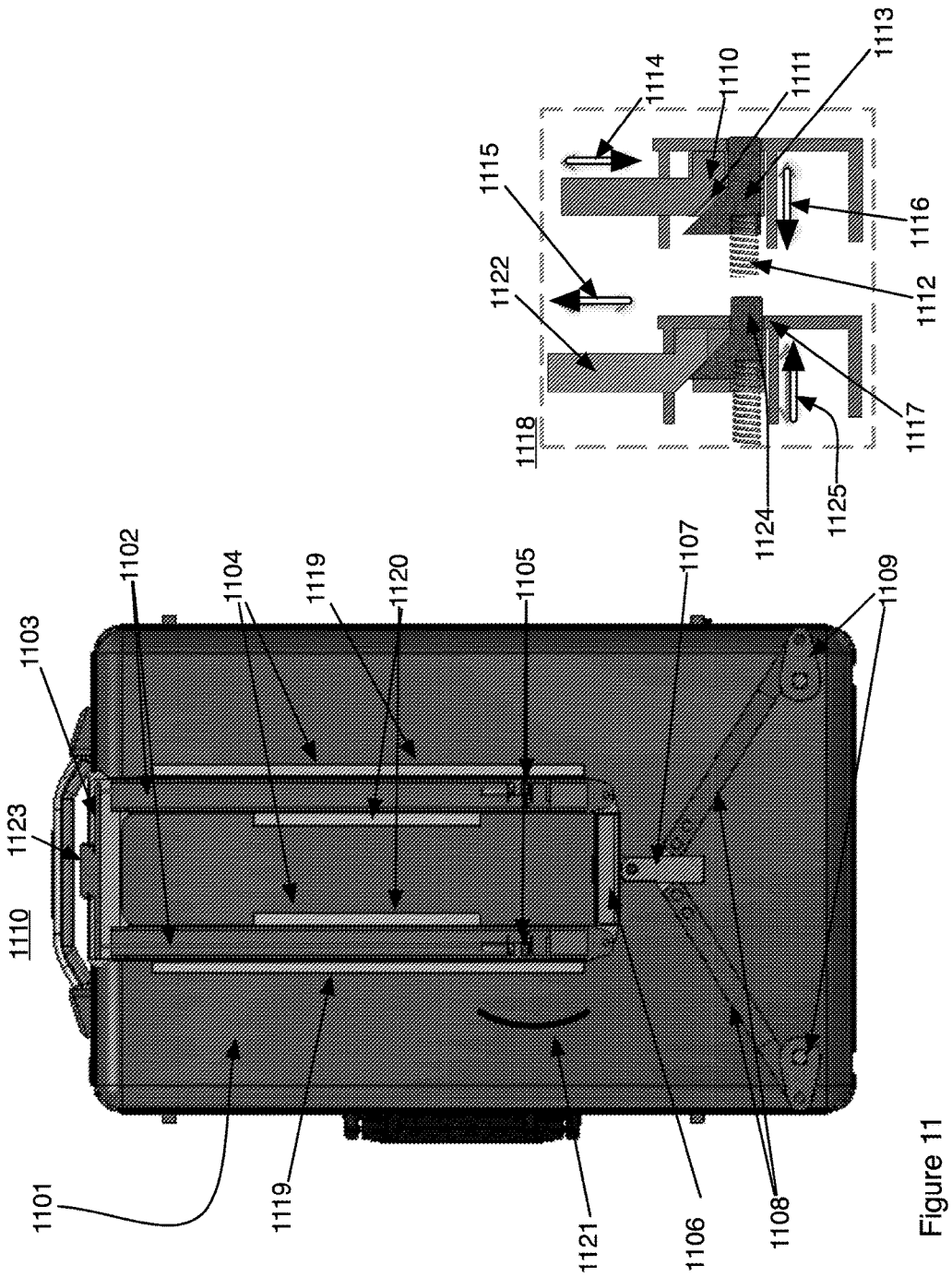
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Figure 11

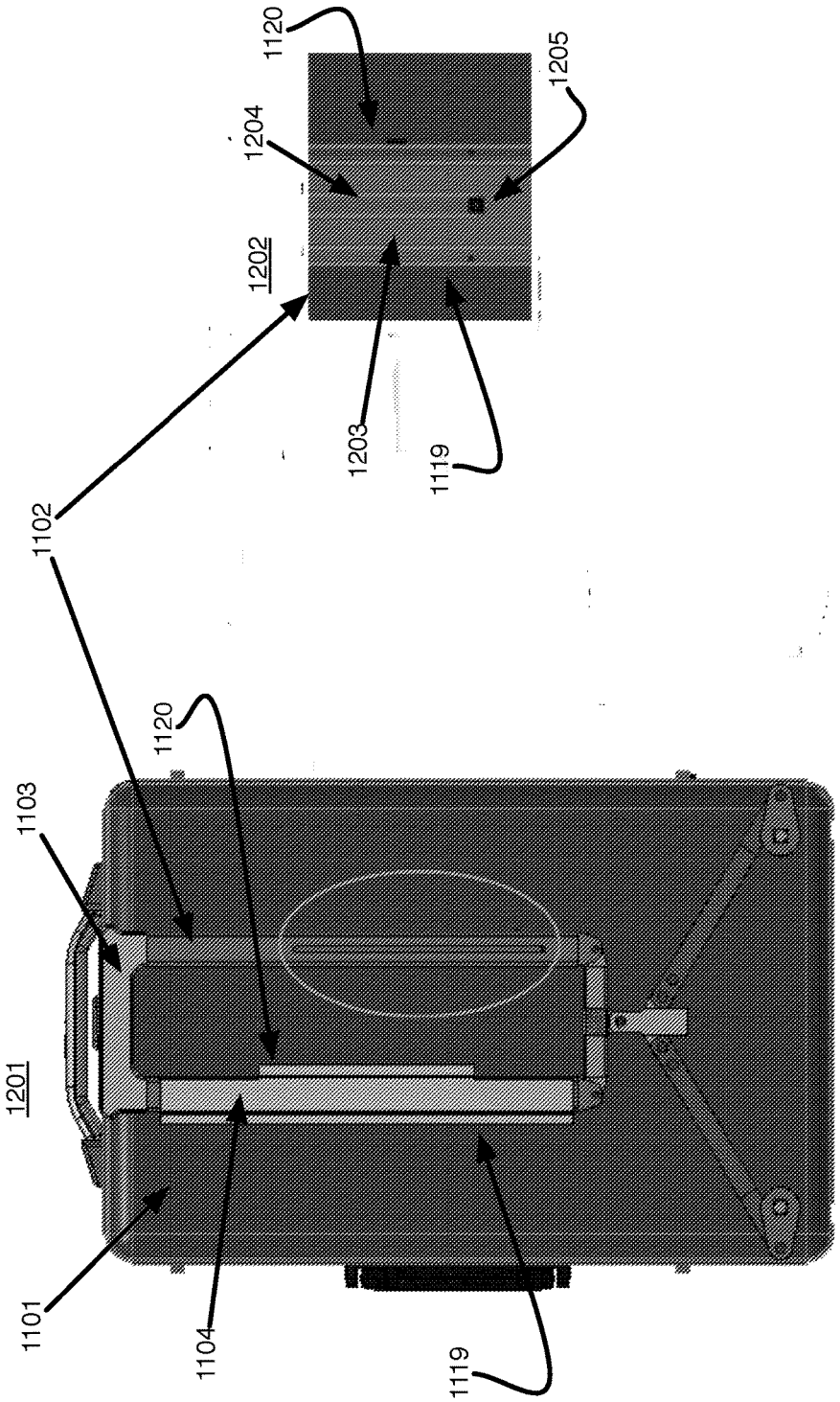
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Figure 12

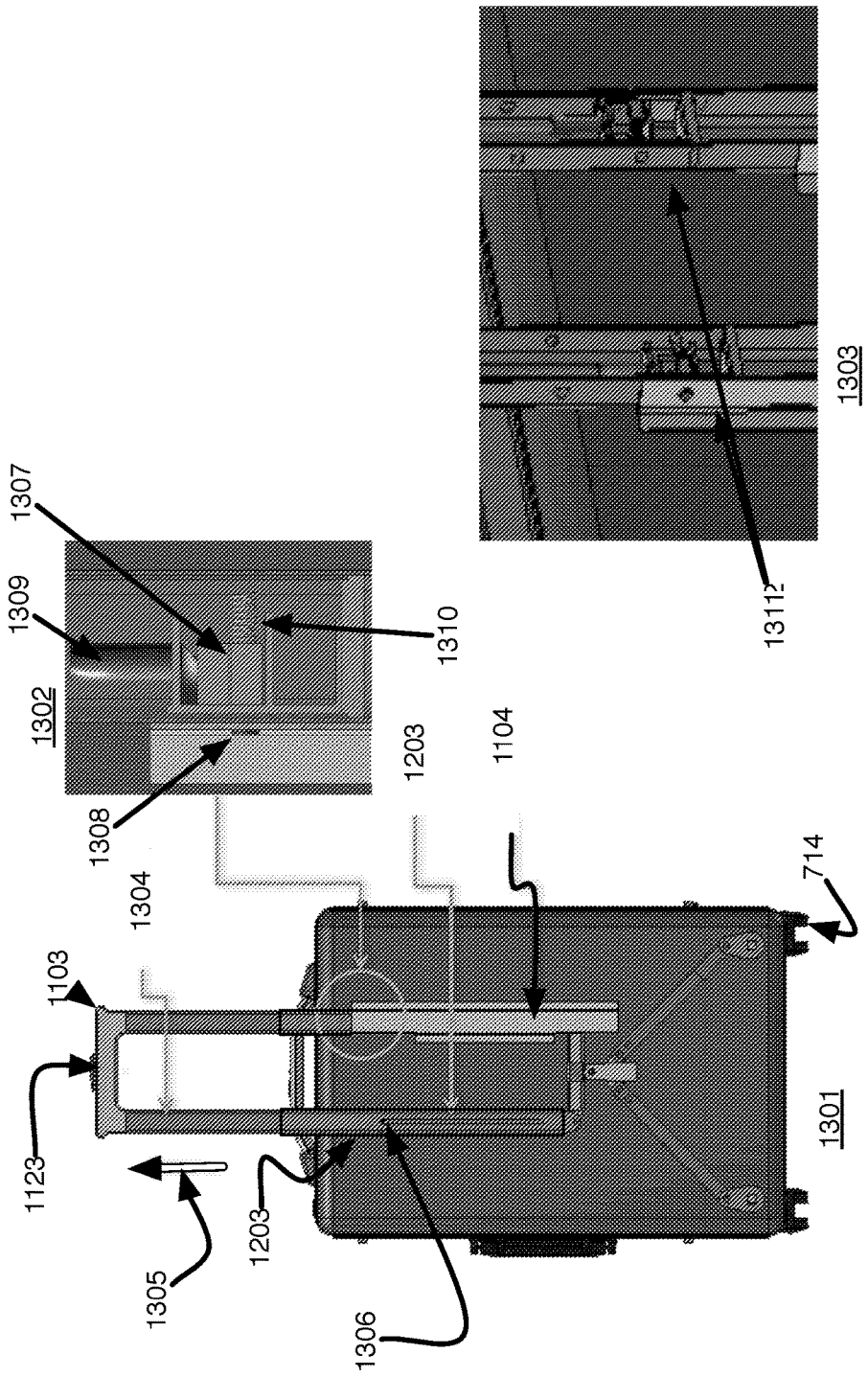
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Figure 13

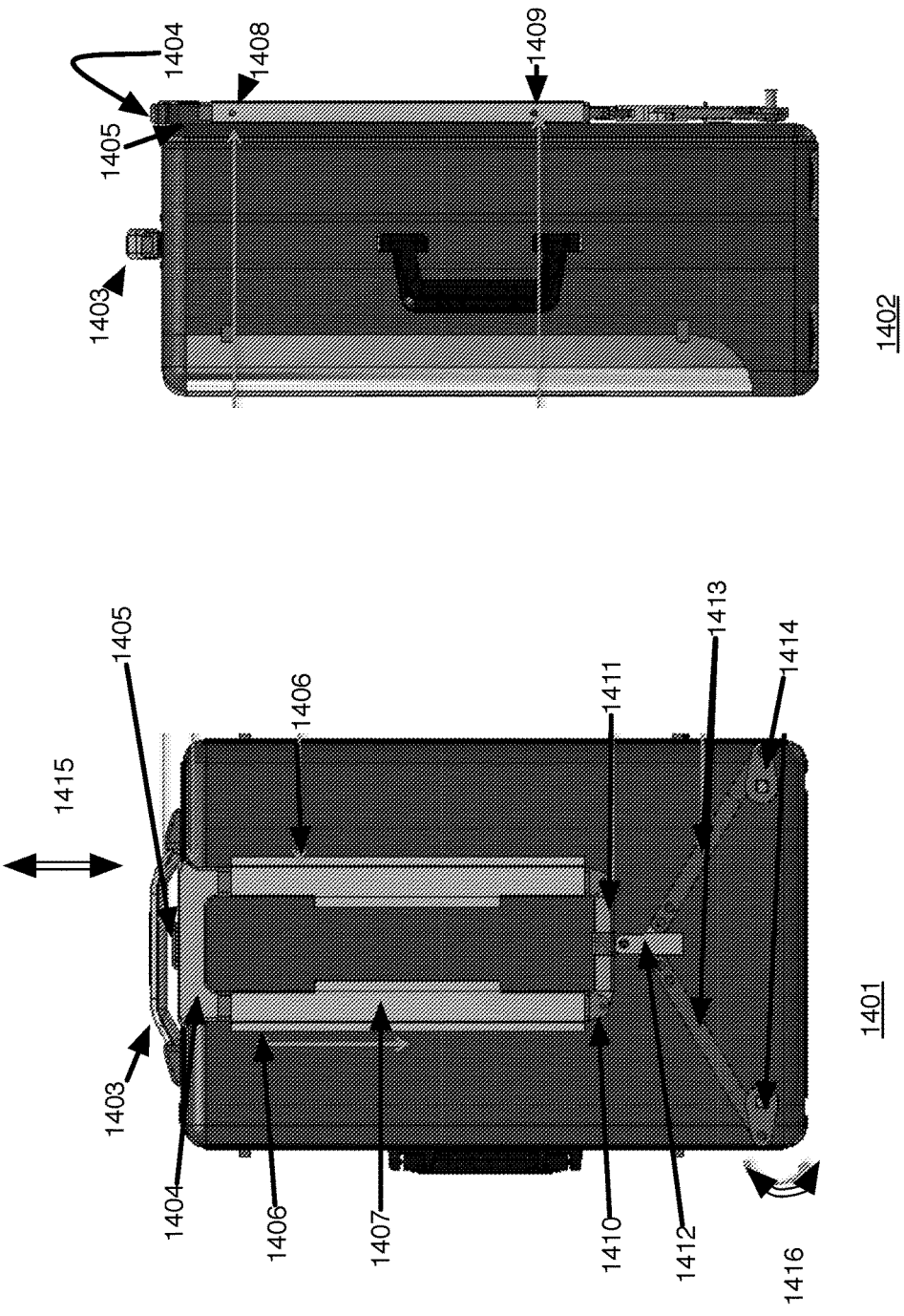
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Figure 14

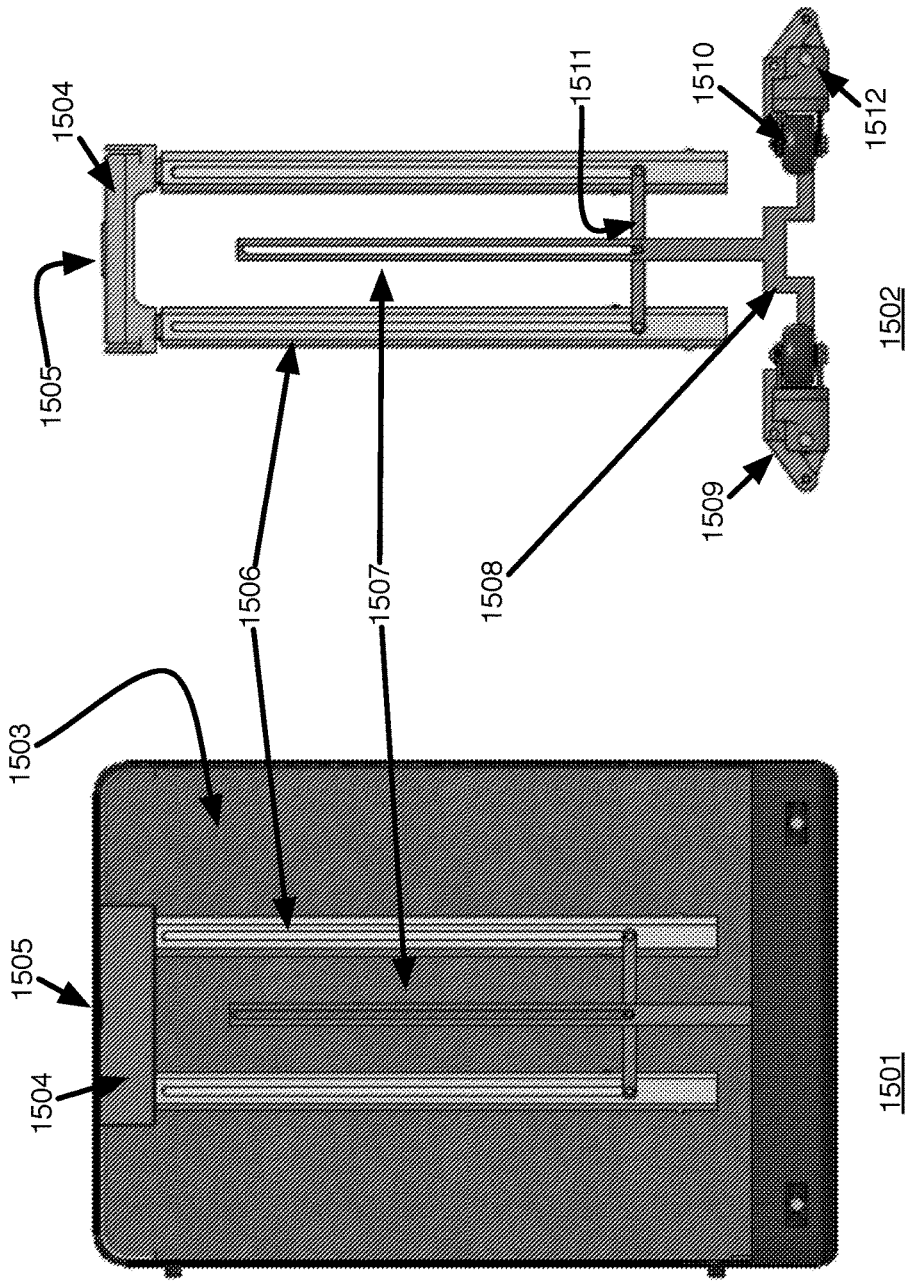
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Figure 15

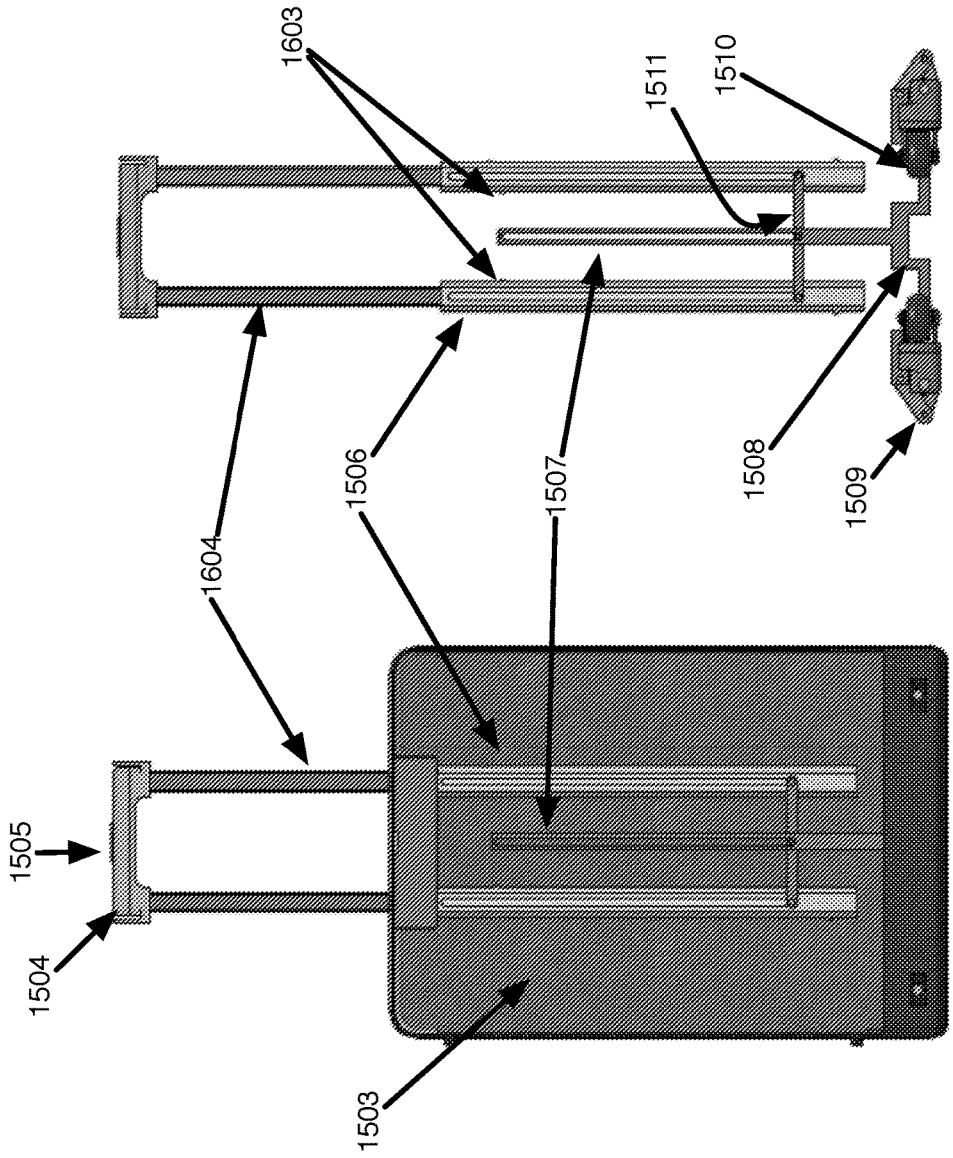
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Figure 16

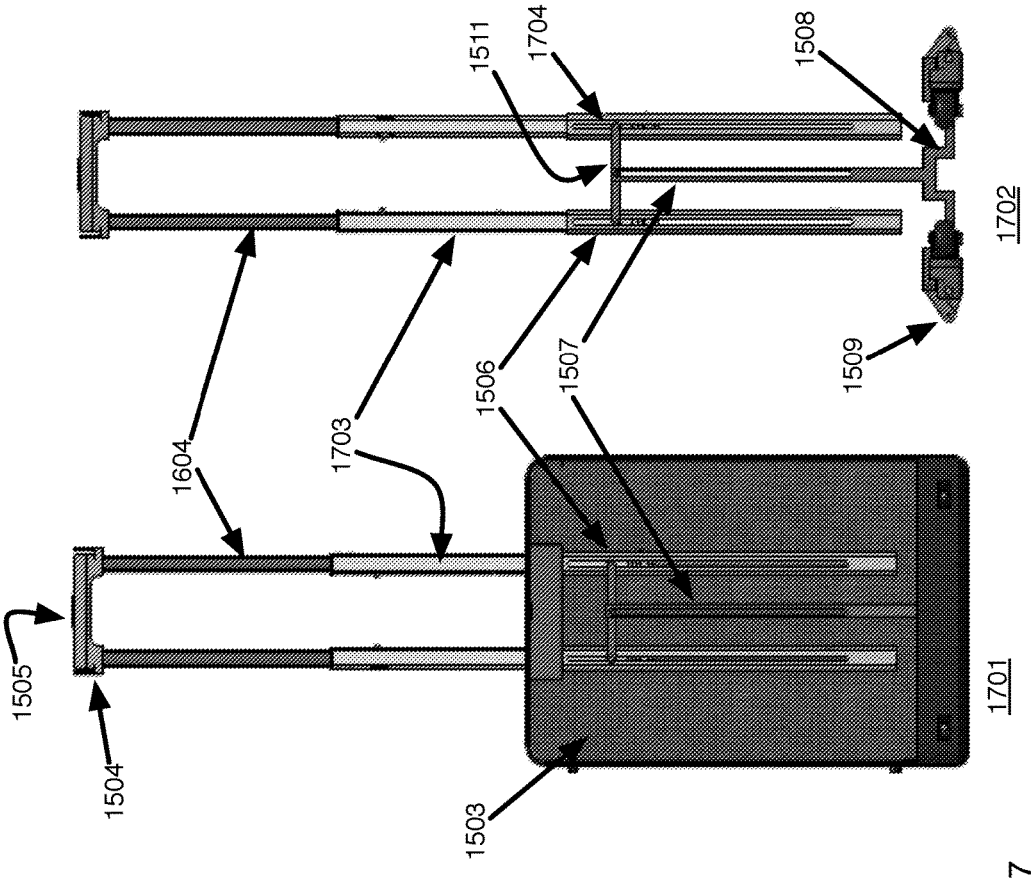
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Figure 17

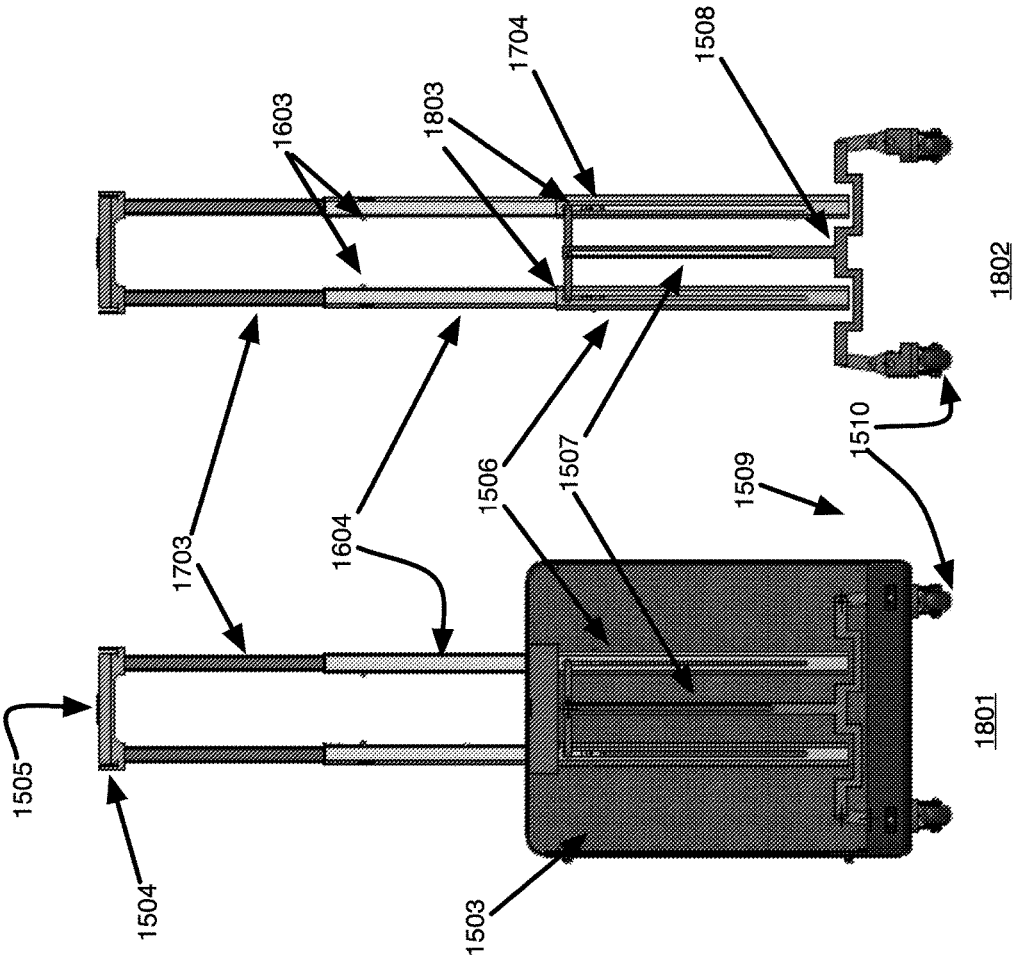
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Figure 18

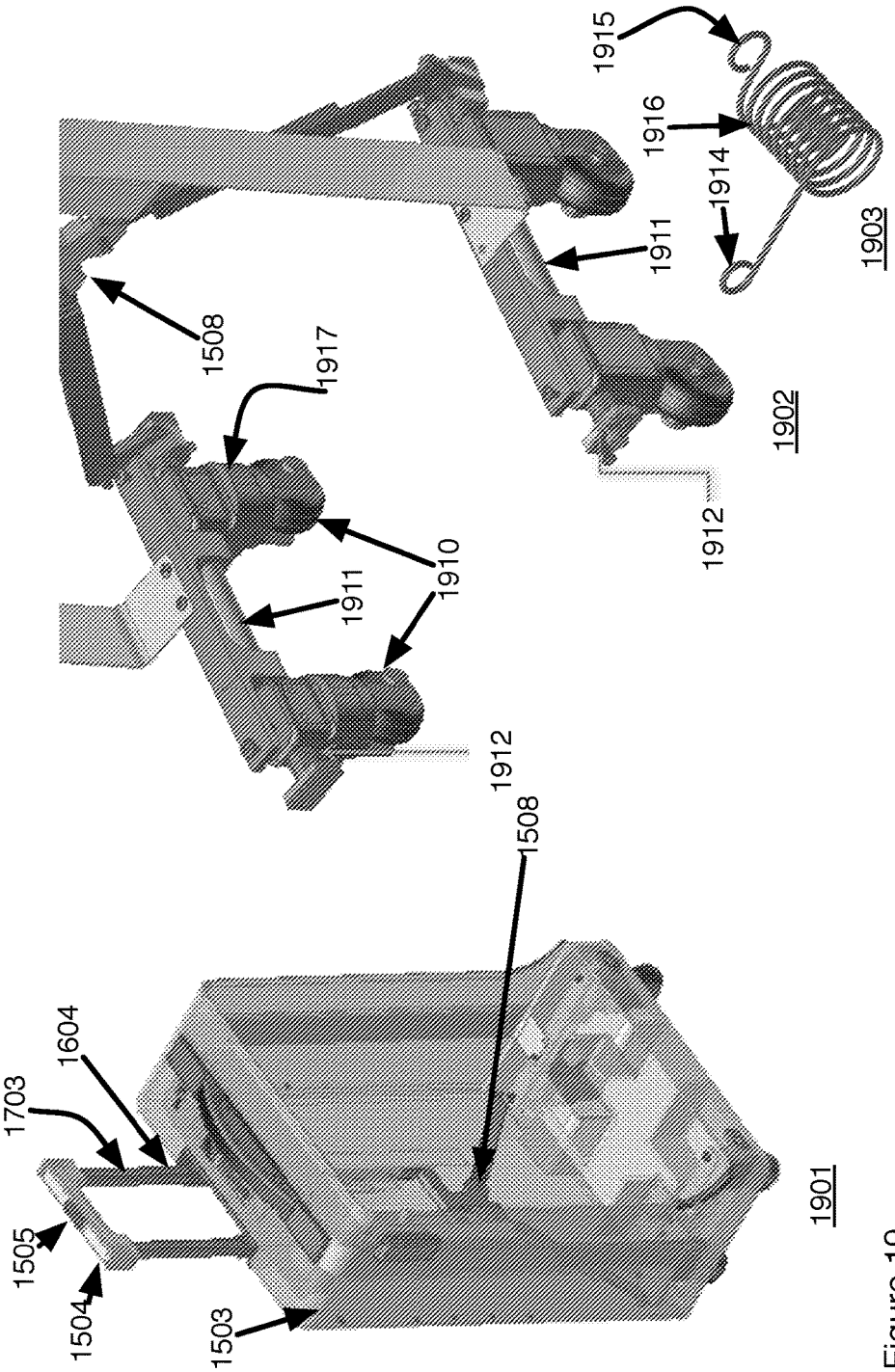
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Figure 19

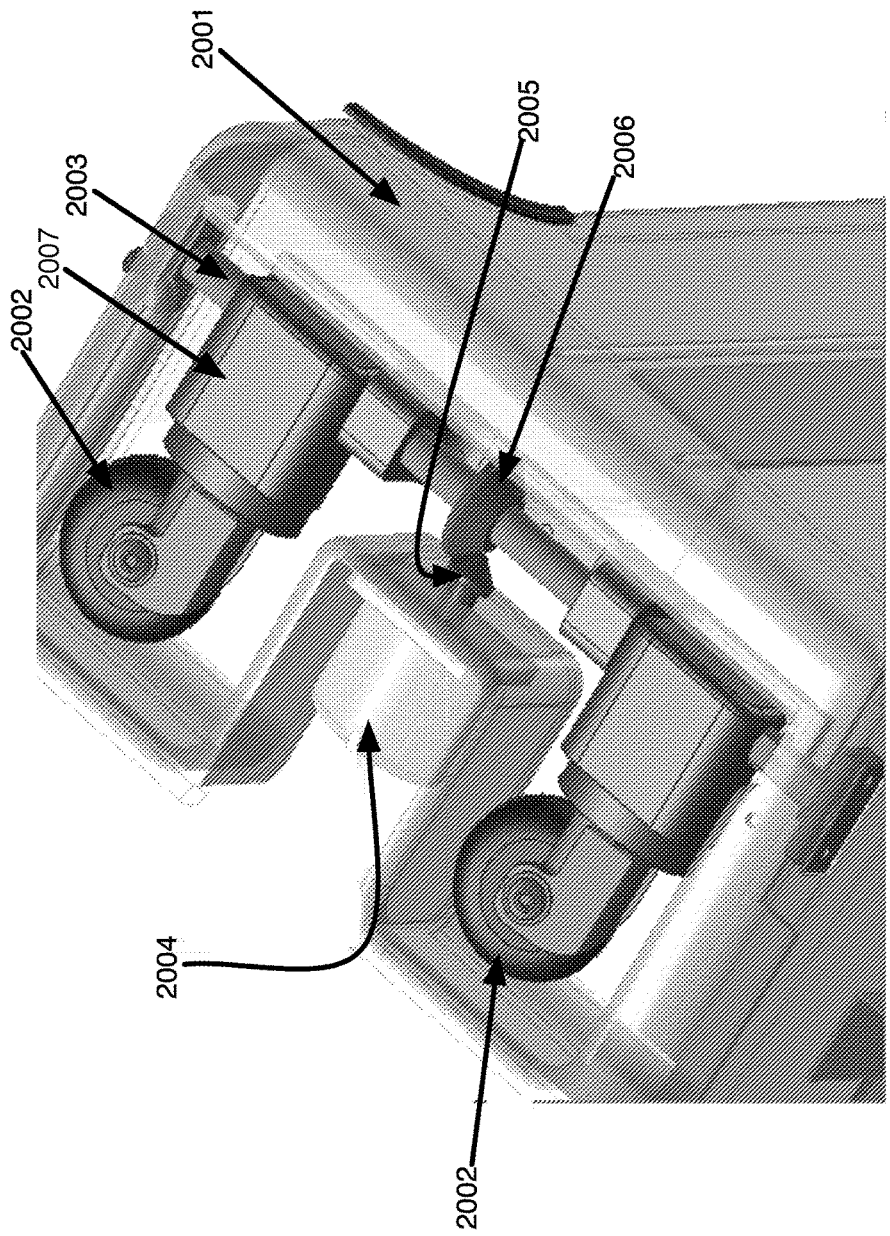

Figure 20

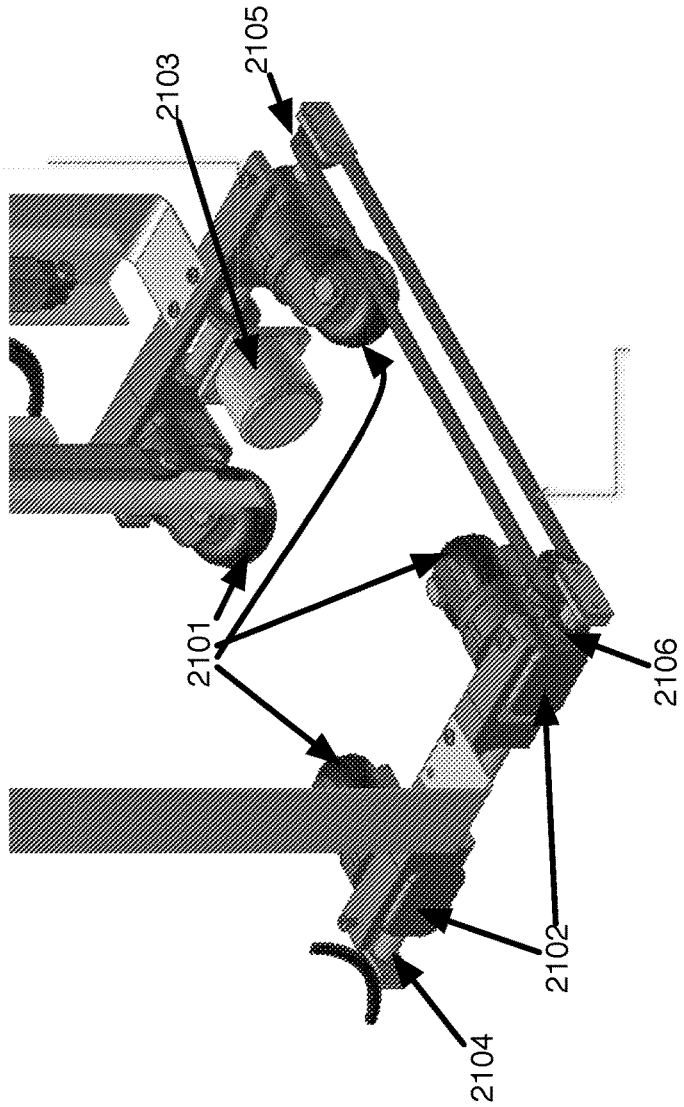

Figure 21

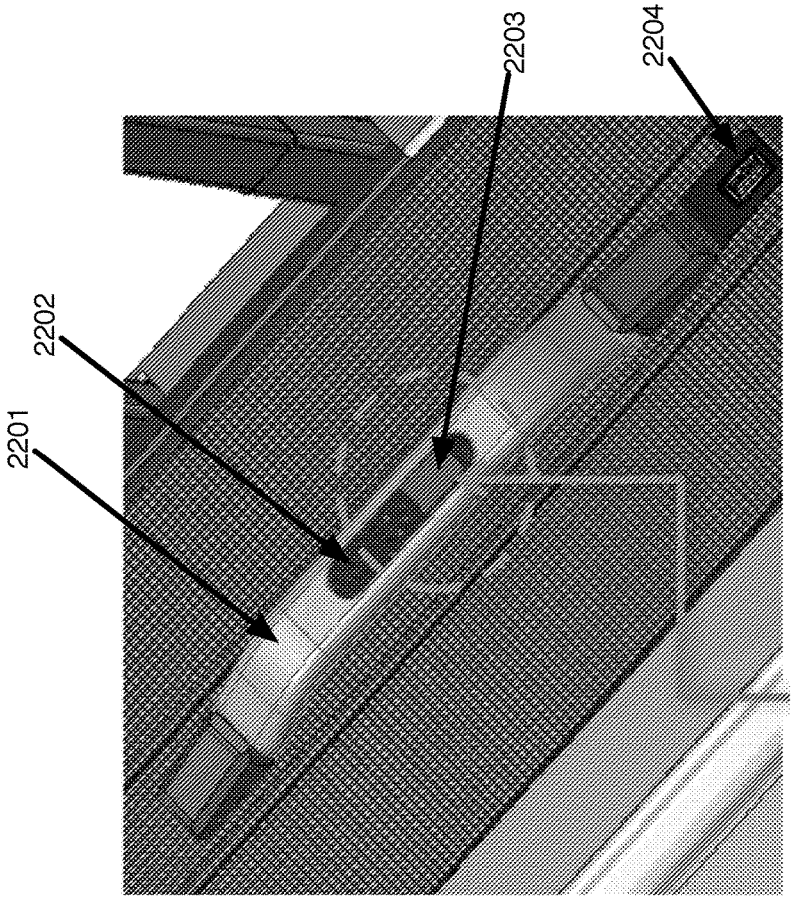

Figure 22

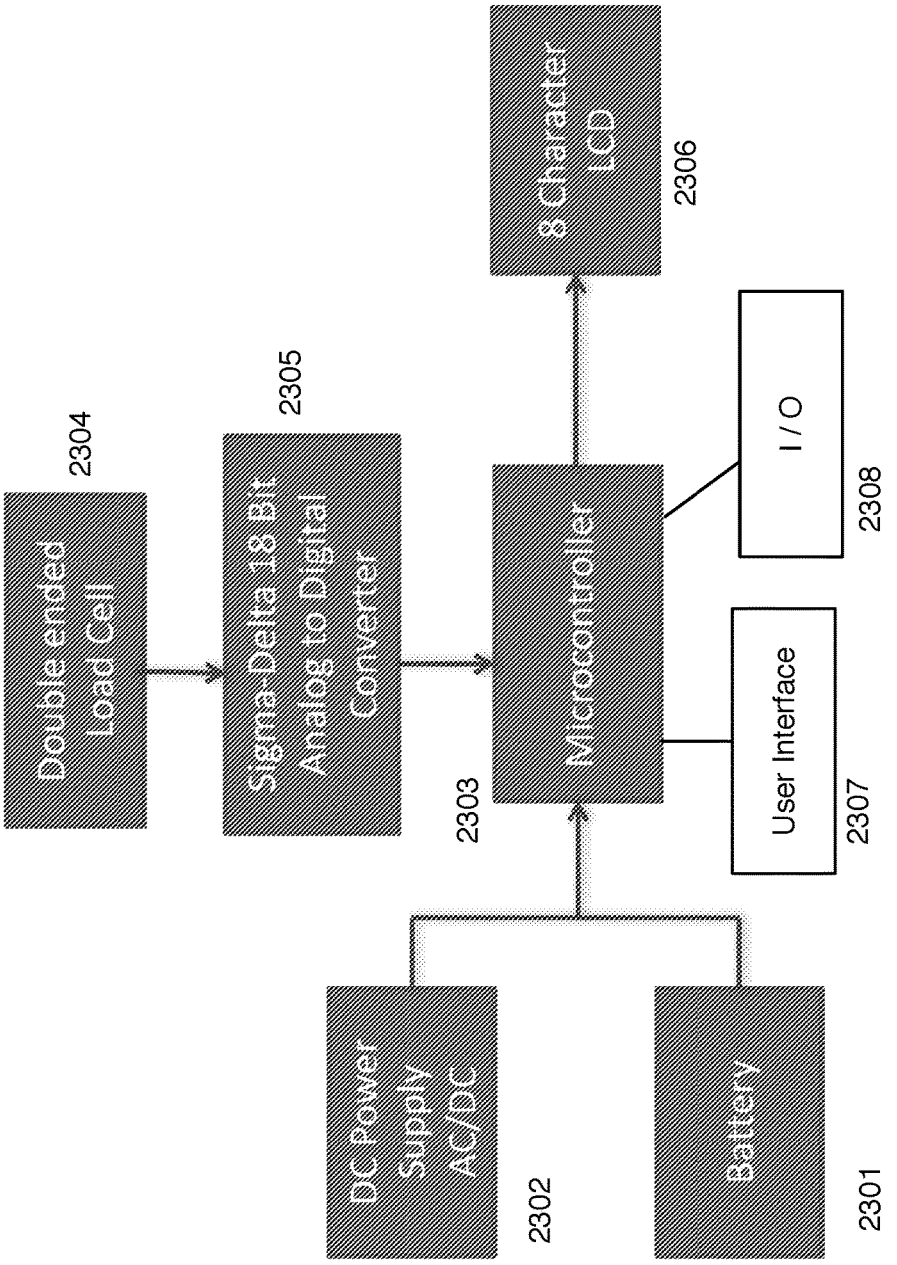
Double ended Load Cell
2304
Sigma-Delta 18 Bit Analog to Digital Converter
2305
8 Character LCD
2306
I / O
2308
Microcontroller
2303
User Interface
2307
DC Power Supply AC/DC
2302
Battery
2301

Figure 23

SUITCASE WITH RETRACTABLE WHEELS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional application 62/361,382, Suitcase With retractable Wheels, filed on 12 Jul. 2016, and to U.S. provisional application 62/393,065, Suitcase With retractable Wheels, filed on 11 Sep. 2016. All applications are by the same inventors and are currently pending.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a suitcase with retractable wheels.

Related Background Art

[0003] Passengers are allowed to carry a limited number of smaller bags with them onto airplanes and into other transport vehicles that contain valuables and items needed during the journey. There is normally restricted storage space provided for hand luggage, either under seating, or in overhead lockers. Passengers may want to have more of their possessions at hand during flight but cannot do so and still fit within the restriction of the allowable baggage size. A typical trolley baggage will have either 2 or four wheels with a telescopic handle for the ease of moving around. When the baggage is stored within the restricted storage space, wheels occupy that extra space when it could have been used for storing that extra luggage. (Size limitation is based on the flight cabin requirements.). Wheels also obstruct the path of baggage removal from the overhead storage and the wheels become "entangled" by catching on the edges of the luggage compartments and on the wheels and/or edges of other luggage within the compartment. Based on these constraints, there is a need to re-design luggage which can give the traveler extra space by utilizing the dead volume occupied by the wheels, more effectively. There is a need for a suitcases that presents smooth surfaces for ease of packing in luggage compartments and that ensure the wheels are not an obstruction during storage and removal from overhead storage.

BRIEF SUMMARY OF THE INVENTION

[0004] A system is described that addresses the deficiencies described above. A suitcase with retractable or projectable wheels is described. The wheels retract so that during storage time, the luggage sizes are within prescribed limits. A new trolley mechanism to be used with a suitcase is described. One embodiment includes foldable wheels. In this embodiment, when the telescopic handle is pulled up/out, the wheels which are initially folded, open up, similar to that of a landing gear of an airplane. When the telescopic handle is pushed down, the wheels fold back into recesses within the suitcase. In one embodiment the wheels remain visible. In another embodiment the recesses include covers that hide the wheels when retracted.

[0005] Another embodiment includes retractable wheels. When the telescopic handle is pulled out, the castor wheels come down vertically and are exposed. When the telescopic handle is pushed down, the castor wheels are pulled vertically up into the luggage and hiding the wheels completely.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] FIG. **1** is a diagram showing a first embodiment of the suitcase with retractable wheels alongside a prior art suitcase.

[0007] FIG. **2** shows front and back perspective views of an embodiment using folding wheels.

[0008] FIG. **3** shows front and side views of the embodiment of FIG. **2** with the wheels in a folded position.

[0009] FIG. **4** Shows a back view and a more detailed view of the folding mechanism of FIGS. **2** and **3**.

[0010] FIG. **5** shows a back and side view of the embodiment of FIGS. **2-4** with the wheels in a folded position.

[0011] FIG. **6** shows two bottom views of the embodiment of FIGS. **2-5**.

[0012] FIG. **7** shows front and back views of a second retractable wheel embodiment.

[0013] FIG. **8** shows back and detailed views of the embodiment of FIG. **7**.

[0014] FIG. **9** shows back and side views of the retractable wheel embodiment of FIG. **7** with the wheels in a retracted position.

[0015] FIG. **10** shows two bottom views of the retractable wheel embodiment of FIG. **7**.

[0016] FIG. **11** shows a back view of a third embodiment of the suitcase including detailed views of the handle latching mechanism.

[0017] FIG. **12** shows a back view of the suitcase of FIG. **11** and details of the slide mechanism for the handle.

[0018] FIG. **13** shows a back view of the suitcase of FIG. **11** and the handle and wheels in the extended position.

[0019] FIG. **14** shows a back view and a side view of the suitcase of FIG. **11** showing the handle mechanism for extending the wheels.

[0020] FIGS. **15-18** shows a fourth embodiment for a mechanism to retract the wheels on a suitcase.

[0021] FIG. **15** shows the fourth embodiment retraction mechanism in a first fully retracted and the handle lowered position.

[0022] FIG. **16** shows the fourth embodiment retraction mechanism in a second position with the handle partially extended and the wheels retracted.

[0023] FIG. **17** shows the fourth embodiment retraction mechanism in a third position with the handle further extended and the wheels retracted.

[0024] FIG. **18** shows the fourth embodiment retraction mechanism in a fourth position with the handle fully extended and the wheels extended.

[0025] FIG. **19** shows an embodiment with the addition of torsional springs to aid in the extension and retraction of the wheels.

[0026] FIG. **20** shows an embodiment that uses a pair of motors for extension and retraction of the wheels.

[0027] FIG. **21** shows an embodiment that uses a single motor and a drive belt for extension and retraction of the wheels.

[0028] FIG. **22** shows some of the electronic components on the suitcase.

[0029] FIG. **23** shows a block diagram of the electronic circuitry included in an embodiment of the suitcase.

DETAILED DESCRIPTION OF THE INVENTION

[0030] Referring to FIG. **1**, a first view **101** shows the present invention and a prior art example suitcase **102**. The suitcases have the same widths **103**, **104** and the same overall heights **105**, **106**. However, it is seen that the prior art suitcase **102** has a significant portion **107** of the overall height taken up by the projection of the non-retractable wheels **108**. Advantages of the retractable wheels in the instant invented suitcase **101** include additional storage space within the suitcase as well as easier handling. The projecting wheels **108** often become snared on other luggage and the walls and entrances of the luggage compartments.

[0031] FIG. **2** a front **201** and a back **202** perspective view of a first embodiment of the invented retractable wheel suitcase. The suitcase is comprised a front panel **203**, a rear panel **204** and top side **205**, a first vertical side **206** and a second vertical side **207**. Wheels, retracted and not visible in these views, are attached in cavities **212** on the bottom side, also not visible in these views. A handle **209** is attached to a column **208** held to the backside **204** using a pin **214** in a slot (not visible) in the back side. The pin and slot connection allows the handle **209** and column **208** to be moved in the vertical direction without removing the column from the back of the case. At the end of the column opposite the handle **209** is attached a Y-junction **210**. Also attached to the Y-junction **210** are two lower arms **211**. The lower arms are further attached to levers **212**. The levers are attached to rods supporting the wheels (all seen in later drawings) such that when the handle **209** is raised or lowered the column **208** raises and lowers the Y-junction **210** and the lower arms **211** that in turn raise and lower the levers **212** thereby unfolding or folding the wheels. The wheels, when in a retracted or folded in position, are enclosed within cavities **213** on the bottom side of the case. FIG. **3** shows a front view **301** and a side view **302** of the same case as seen in FIG. **2**. All of the parts numbered in FIG. **3** are the same corresponding parts numbers and as discussed in conjunction with FIG. **2**.

[0032] A more detailed description of the mechanism for retracting the wheels is shown in FIG. **4**. The first view **401** is of the back **204** of the case and the second view **402** is a magnified view of the Y-connector as indicated by the dotted circles and lines. The wheels are retracted and extended by movement of the handle **209** vertically **407** either up or down. The handle is shown in an extended or up position thereby rotating **408** the levers **212** into a vertical position which causes the wheels **403** to rotate **409** away from the case and remain in an extended position, as shown, for use. Pushing down on the handle similarly causes the levers **212** to rotate **408** such that the wheels **403** rotate **409** into the recess **213** and are thereby retracted. The second view shows the Y-connector **210**. The vertical column **208** is connected to the Y-connector **210** by a bolt or rivet **404**. The bolt or rivet **404** connection of the vertical column **208** that is attached to the handle **209** need not rotate but rather is held in the fixed position as shown. The connectors **404** to the lower arms **211** are either bolts or rivets and are able to rotate **410** such that when the handle **209** and therefore the column **208** is raised or lowered, the Y-connector **210** is raised or lowered and the lower arms push or pull respectively upon the levers **212** thereby rotating the wheels to either an extended or retracted position. The bottom ends of the lower arms **211** are attached to the lever **212** using either a bolt or rivet **405** that can be rotated.

[0033] The retraction motion is further illustrated in FIG. **5**. Both a back view **501** and a side view **502** are shown with the wheels in a retracted position. As the handle **209** is moved downward **505** the connector **208** pushes downward on the Y-connector **210** causing the lower connectors **211** to move downward and apart **504** thereby rotating **503** the lever arms **212** and retracting the wheels. The connector **405** of the lower arms **211** is seen to rotate about the connection point.

[0034] FIG. **6** shows two bottom views **601**, **602** off the retraction mechanism. The lower arms **211** are connected at their top end to the Y-connector **210** and at their bottom ends to shafts **605**. The Shafts **605** are held to the bottom **609** of the suitcase using brackets **604** that allow the shafts to rotate in the direction shown **608** about their long axes **607**. The wheels **403** are attached to the shafts **605** using connectors **603**. Rotation of the shaft causes the connectors **603** to also rotate thereby retracting or extending the wheels **403**.When the handle **209** (see earlier Figures) is pressed downward. The lower arms **211** move the levers **212** such that the shafts **605** rotate thereby moving the wheels **403** into a retracted position and within the cutouts **606** on the bottom **609** of the case.

[0035] In another embodiment (not shown) the linkage **208**, **209**, **210**, **211**, **212** is located on the inside of the suitcase. In another embodiment (not shown) the suitcase further includes a shell that attached to the back of the suitcase and thereby encloses the linkages **208**-**212**.

[0036] In a second embodiment, shown in FIGS. **7**-**10** an analogous mechanism is used to retract wheels of a suitcase where, rather than the wheels folding and unfolding in a direction that is perpendicular to the shaft supporting the wheels, the wheels extend and retract vertically.

[0037] Referring to FIG. **7**, the case is shown as a front view **701** and a back view **702**. The case is comprised of a front **703**, a back **704** a top **705**, a bottom **706** and two sides **707**, **708**. Attached to the back of the case is a shaft **709** that includes a handle grip **710** at its top. The bottom end of the shaft is attached to a Y-connector **711**. The shaft may be moved up and down in a vertical direction **715**. Also attached to the Y-connector **711** are two diagonal arms **712** that are in turn attached to two vertical lower arms **713**. Movement of the handle **710** and shaft **709** in the up and down direction also causes the two vertical lower arms to move in an up and down direction **716**. The lower end of the vertical arms **713** are attached to a support (not visible in this Figure) for a set of wheels **714**. The linkage of the handle **710**, vertical shaft **709**, Y-connector **711**, diagonal arms **712** and lower vertical arms **713** enables extension and retraction of the wheels **714** when the handle **710** is moved in the up and down direction respectively.

[0038] FIG. **8** shows three views **801**, **802**, **803** that provide more detail of the linkage. Items are consistently numbered in all of the Figures. Some numbered items in FIG. **8** are already described above. A back view **801** of the suitcase shows the linkage items just discussed. Closeup views **802**, **803** show details of the linkage. The vertical shaft **709** and the two diagonal arms **712** are attached to the Y-connector using bolts or rivets **804**. The connection allows rotation of the diagonal arms **712** in the plane of the Y-connector. The Diagonal arms are each attached to the

back of the case with another bolt or rivet **807** that acts as a pivot point or fulcrum such that as the Y-connector moves down the opposite end of the diagonal arm **805** moves upward. The lower, vertical arms, **713** are in turn attached to the lower end of the diagonal arms with a bolt or rivet that is mounted inside a slot **806**. The slot mount results in vertical up and down motion of the vertical arms **713** when the vertical shaft **709** and handle **710** are moved. The location of the pivot point **807** in the direction **808** along the diagonal arm **712** determines the amount of motion of the lower arms **713** relative to the amount of motion of the handle **710** and vertical shaft **709**. That is, in use, one would expect that the handle might typically move approximately 12 inches. Extension and retraction of the wheels would require a motion of only the height of the wheels **809**, typically 3 inches or less. The location of the pivot point **807** is therefore selected along the direction **808** to provide such a motion.

[0039] FIG. **9** shows a back view **901** and a side view **902** of the suitcase with the wheels **714** in a retracted position. When the handle **710** is pushed down **905** into a retracted position, the diagonal arms **712** pivot about the pivot point **807** causing the vertical lower arms **713** to move upward **904**. The lower end of the lower arms is attached **906** to a support for the wheels (not shown) such that when the support is pulled vertically the wheels **714** retract into compartments **903** within the base of the suitcase.

[0040] FIG. **10** shows two views **1001**, **1002** of the bottom **706** of the suitcase. The lower vertical arms **713** are attached **1003** to a support **1005** to which the wheels **714** are attached. Movement of the supports **1005** in the vertical direction causes the wheels to extend and retract from the cavity **903** in the bottom of the case.

[0041] In another embodiment (not shown) the linkage **709**, **710**, **711**, **712** and **713** is located on the inside of the suitcase. In another embodiment (not shown) the suitcase further includes a shell that attached to the back of the suitcase and thereby encloses the linkages **709-713**.

[0042] In a third embodiment shown in FIGS. **11-14** the linkage includes telescoping tubes. Referring to FIG. **11**, a first view **1110** shows the back **1101** of the suitcase to which the handle and wheel deployment and retraction mechanism is attached. Details of the latching mechanism incorporated into the deployment and retraction mechanism are shown in the second view **1118**. The deployment mechanism is comprised of a pair of parallel concentric tubes **1102** that are themselves contained in a concentric housing **1104**. Only the outer tube of the concentric tubes **1102** can be seen in the Figure. The concentric tubes are connected at a top end by a handle **1103** and at the bottom end by a horizontal bar **1106**. The suitcase user grasps the handle **1103** and pulls upward to extend the wheels and pushes downward to the position shown in the figure to retract the wheels. The bottom horizontal bar **1106** moves upward when the handle **1103** is pulled upward thereby pulling the pair of diagonal arms **1108** upward which rotate the brackets **1109** and extend the wheels. The action of the diagonal arms **1108** and the brackets **1109** to extend and retract the wheels is much as already described in the preceding Figures. The housing **1104** for the concentric tubes is fixed to the back of the suitcase **1101** and is comprised of a pair of outer walls **1119** that extend top to bottom to along the length of the inner concentric tubes **1102**. The housing includes inner walls **1120** that are foreshortened at the bottom end **1121** to allow movement of the bar **1106** vertically as the handle **1103** is raised. The deployment and retraction mechanism further includes spring loaded latches **1105** that releasably latch the concentric tubes **1102** in either the lowered position, as shown in the Figure, or in the raised position, shown in FIG. **13**. The latching ensures the wheels are locked in place either in the extended position (FIG. **13**) or the retracted position (FIGS. **11** and **12**). The latching mechanism is shown in the second view **1118**. The Mechanism is comprised of a spring loaded latch that includes a peg **1124** that is pushed by the spring through a hole **1117** in the wall of the concentric tubes and a second hole in the wall of the outside channel **1119** thereby securing the concentric tubes **1102** in place. The latch is controlled by a rod **1122** located in the center of the concentric tubes **1102** that is connected to a button **1123** on the top bar **1103** across the concentric tubes. The button **1123** is spring loaded to exert tension in the upward **1115** direction when the button is released thereby causing the spring loaded match to move in the latching direction **1125**. When the button **1123** is depressed the rod **1122** moves in the downward direction **1114** thereby providing downward pressure on the mated slanted surfaces **1111** on the end of the rod and on the top of the latching mechanism **1113** and cause the latch to retract by moving in the direction **1116** shown. Once retracted the handle **1113** may be pulled upward and move the wheels to an extended position.

[0043] FIG. **12** shows some additional details of the concentric tubes **1102** that are used to actuate the wheel release mechanism and also act as the extended handle when the suitcase wheels are extended and the suitcase is transported by rolling upon the extended wheels. The first view **1201** shows the back of the suitcase **1101** including the housing **1104**, the two sides of the housing **1119** and **1120**, and the concentric tubes **1102**, all already discussed in conjunction with FIG. **11**. The second view **1202** shows some additional details of the concentric tubes. The outer concentric tube **1203** includes a slot **1204**. The inner concentric tube not visible includes an attached pin **1205** that maintains alignment between the inner and outer concentric tubes as the handle **1103** is raised and lowered. FIG. **13** shows three views **1301**, **1302**, **1303** of the details of the mechanism to lock the handle in place once the wheels are extended. In the first view **1301**, the inner tube **1304** is pulled upward **1305** until the pin in the slot reaches the top position **1306**. At this point both the inner **1304** and the outer **1203** concentric tubes are fully extended and the wheels **714** are also fully extended as shown. The two concentric tubes **1203**, **1304** are locked to the housing using a spring loaded pin that is forced through a hole in the housing when the pin reaches the point of the hole as the handles are raised. The mechanism is shown in the second view **1302**. The pin **1308** is mounted on a block **1307** that is pushed by a spring **1310**. With the pin **1308** in the extended position as shown the wheels and concentric tubes are locked in place for rolling the suitcase during transport. The wheels are retracted by releasing the pin by pushing on the button **1123** that pushes the rod **1309** downward. There are mating slanted surfaces on the rod **1309** and the block **1307** such that as the rod moves downward the slanted surfaces move the block back from the hole and peg **1308** and compress the spring **1310**. The handles may then be pushed downward thereby retracting the wheels **714** for stowage. The release mechanism shown in view **1302** is the same as that discussed in conjunction

with FIG. **11** in the second view **1118**. There are release mechanisms on each **1311** of the two pairs of concentric tubes as is shown in the third view **1303**.

[0044] FIG. **14** shows a back **1401** and a side **1402** view of the embodiment of FIG. **11**. The suitcase with retractable wheels includes a first handle **1403** that is used to lift the suitcase when the wheels are retracted. The first handle further includes a strain gauge and display that provides a weight measurement of the suitcase. A second handle **1404** is used to extend and retract the wheels when the handle is moved in the up and down direction **1415** relative to the body of the suitcase. The second handle includes a button **1405** that releases the latches (already described) that are included within a set of concentric shafts **1406**, **1407**. The first set of concentric shafts **1406** (only one of the pair is labeled is attached to the back of the suitcase. A second set of concentric shafts **1407** is positioned telescopically within the first set of shafts **1406** and slides upward and downwards within the shafts. The bottom end **1410** of the second set of concentric shafts includes a cross brace **1411**. A vertical member **1412** is attached at the center of the cross brace and a pair of pivoting arms **1413** are attached at a first end to the vertical member. When the handle **1404** is pulled in the vertical direction **1415** upward and away from the body of the suitcase the second concentric shaft **1406** moves vertically pulling on the pivoting arms **1413** which are attached at a second end to pivot members **1414** that through the movement pivot in a direction **1416**. The pivot members are attached to shafts (not labeled) to which wheels are attached such that pivoting of the pivot members **1414** causes the wheels to be extended downward and the suit case may then be placed on moved by rolling on the wheels. When the concentric shafts are fully extend the spring loaded locking mechanisms lock the shafts in position and therefore also lock the wheels in an extended position. Pushing the release button **1405** releases the spring loaded locking mechanisms on the concentric shafts and allows the handle **1404** and the center movable concentric shaft **1407** to be moved in a downward direction. Movement of the shaft **1407** downward causes the pivot mechanisms **1414** to rotate thereby rotating the shafts to which the wheels are attached and thereby retracting the wheels.

[0045] In another embodiment, shown in FIGS. **15-18**, a suitcase with retractable wheels that includes another embodiment of the wheel retraction mechanism is shown. Each of the Figures show a first view of the mechanism attached to the suitcase and a second view where just the mechanism is shown. Referring to FIG. **15** the suitcase **1501** and mechanism **1502** are shown in a first position with the wheels in a fully retracted position. This is the position that the suitcase would ideally be in for storage. The wheel retraction mechanism includes a handle **1504** and a release button **1505** on the handle such that pushing the release button activates spring loaded latches that are located in the interior of concentric shafts **1506**. This embodiment includes three concentric shafts that telescope within each other. The outermost shaft **1506** is the only one of the three shafts visible in this first view of the embodiment and is fixedly attached to the back of the suitcase **1503**. The lower end of a third concentric shaft (not visible) is attached to a cross brace **1511** that includes a pin that fits within a slotted shaft **1507**. The slotted shaft is attached to a T-shaped mechanism that attaches to pivots **1509** that are in turn attached to shafts **1512** on which the wheels **1502** are attached such that raising of the slotted shaft **1507** causes the T-shaped mechanism to move vertically relative to the fixed shaft and the suitcase thereby rotating the pivots **1509** and the shafts **1512** and extending the wheels. Details of this movement are seen in the next three Figures. The second **1604** of the concentric shafts is seen in both views **1601**, **1602** of FIG. **16**. The handle **1504** in this view has been lifted to an intermediate position. The wheel t-shaped mechanism **1508** and the attached slotted shaft **1507** are not yet engaged by the cross brace **1511** and the pivot mechanism **1509** and therefore the wheels **1510** remain in the retracted position. The shaft **1604** at this position engages spring locks **1603** that lock the second concentric shaft **1604** to the third telescopic concentric shaft not yet visible in this Figure. Continued lifting of the handle **1504** causes the third concentric shaft **1703** to be lifted telescopically from the interior of the first concentric shaft and thereby lift the cross brace and the pin within the slotted shaft **1507**. At this intermediate position shown of the mechanism **1702** the pin just reaches the top of the slotted shaft **1507** but has not yet lifted the slotted shaft and therefore the T-shaped mechanism relative to the fixed shaft **1506** and the suitcase **1701**. The wheels **1510** remain in a retracted position. Continued lifting of the handle **1504** as shown in the two views **1801**, **1802** of FIG. **18** causes the pin on the vertical brace **1511** to engage the top of the slotted shaft **1507** and thereby lift the T-shaped mechanism, causing the pivots **1509** to rotate and thereby rotate the shaft to which the wheels **1510** are attached and therefore pivot the wheels into an extended position. The third concentric shaft locks at this position using spring loaded lock mechanism **1803**. Pushing the button **1505** releases all **1603**, **1803** of the four spring loaded lock mechanisms (two on each of the pair of shafts) and allows the shafts to be moved telescopically back through the positions shown in the the previous FIGS. **17**, **16**, **15** consecutively and thereby move the wheels **1510** back to a retracted position as shown in FIG. **15**.

[0046] Another embodiment of the suitcase of FIGS. **15-18**, shown in FIG. **19** further includes a coil spring to facilitate the retraction and extension mechanism of the wheels. A first view **1901** shows a suitcase **1503** with retractable wheels the suitcase includes the handle and concentric shaft mechanism already described in the FIGS. **15-18**. The second view **1902** shows just the wheels **1910** and retraction mechanism. The wheels **1910** are attached to swivel mechanisms **1917** that are in turn attached to shafts **1911**. Lifting and lowering of the handle **1504** causes the retraction mechanism T-shaped portion of the retraction mechanism to lift and thereby rotate the shafts **1911** as already described causing the swivel mechanisms and therefore the wheels **1910** to be extended away from and retract back towards the base of the suitcase **1503** respectively. The embodiment further includes a coil spring **1912** that is placed on each of the shafts **1911**. The coil spring includes a central spring **1916** and ends **1914**, **1915**. One of the ends **1914** is attached such that it rotates relative to the other end **1915** when the wheels are moved in either an extension or retraction position thereby placing a strain on the coiled spring **1916**. The strain is released as the wheels are moved towards the opposite direction. In a preferred embodiment the spring is attached such that the coil **1916** is compressed as the wheels are retracted and released as the wheels are extended thereby providing a spring loaded impetus to extending the wheels.

[0047] In another embodiment, shown in FIG. **20**, the manual mechanism for raising and lowering the wheels of a suitcase is replaced with a motorized version. This embodiment includes a suitcase **2001** to which a set of wheels **2002** (only two are shown in the figure) that are attached to a swivel mechanism **2007** that is in turn attached to a shaft **2003**. A motor **2004** is also attached to the base of the suitcase and the shaft of the motor includes a beveled gear **2005** that engages second beveled gear **2006** on the shaft **2003**. Rotation of the motor shaft **2005** in a first direction causes the wheel shaft to rotate and the wheels are extended away from the base of the suitcase. Rotation of the motor shaft in the opposite direction causes a rotation of the wheel shaft **2003** in the opposite direction and the wheels are returned to the retracted position shown in the Figure. In a similar embodiment shown in FIG. **21**, the wheels **2101** are attached to swivel mechanisms **2102** which are in turn attached to shafts **2104**. A single motor **2103** rotates a first shaft through a gearing system equivalent to that shown in FIG. **20**. The first shaft is connected to the second shaft through a belt **2105**, pulley and gear system such that rotation of he first shaft by the motor causes rotation of the second shaft in the opposite direction such that all four wheels **2101** are simultaneously extend or retracted depending upon the direction of rotation of the shaft on the motor **2103**.

[0048] The suitcase further includes electronic devices. FIG. **22** shows the top of a suitcase the handle **2201** includes a strain gauge (not seen) and a display **2202** such that when the suitcase is lifted by the handle the weight of the suitcase is displayed on the display **2202**. In another embodiment the strain gauge is located in the base of the suitcase and when the base of the suitcase is placed upon a firm surface the weight of the suitcase is shown on the display **2202**. The electronics further include a means for near field communication, such as an RFID tag, a built in WI-FI or a Bluetooth connection that is in communication with a portable electronic device remote from the suitcase. The portable electronic device is programmed to signal the user when the suitcase is near the device such as would be the case at a baggage claim when the suitcase appears on the baggage carousel. In another embodiment communication between the portable electronic device and the suitcase includes a light **2203** that flashes on the suitcase to signal the owner of the suitcase that his/her suitcase is nearby. In another embodiment the suitcase includes a power supply such as a battery and an outlet **2204** that may be used to charge portable electronic devices. A block diagram of the electronic components included in one embodiment of the suitcase is shown in FIG. **23**. The electronic components include a battery **2301**. The battery is connected to a power supply management system **2302**. In one embodiment the power supply management includes an AC/DC converter such that the suitcase may be plugged into a wall outlet for recharging the battery **2301**. In another embodiment the power supply management system further includes an inverter such that an AC appliance may be plugged into the suitcase for operation or charging of devices requiring an AC supply. The battery and power management system supplies power to a microcontroller **2303** the microcontroller powers and controls output to the user interface **2307** wherein the user interface is the display **2306** and light described in FIG. **22**. The I/O includes the means for near field communication to a remote portable electronic device. The microprocessor also receives a signal from the strain gauge/load cell **2304** through an Analog to Digital converter **2305** and is further programmed to translate the signal to a weight which is displayed on the display **2306**.

Summary

[0049] A suitcase with retractable wheels is described. A linkage provides a means to raise and lower wheels either by a vertical motion or a folding motion such that the wheels may be extended for rolling the suitcase when the use is walking and the wheels may be retracted for easy stowage of the suitcase such as in a luggage compartment. The linkage may be attached to the back of the suitcase, located in the interior of the suitcase or enclosed in a shell that is attached to the back of the suitcase.

[0050] Those skilled in the art will appreciate that various adaptations and modifications of the preferred embodiments can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that the invention may be practiced other than as specifically described herein, within the scope of the appended claims.

We claim:

1. (canceled)

2. (canceled)

3. (canceled)

4. (canceled)

5. A suitcase with retractable wheels, the suitcase having a front surface, a back surface a top surface, a bottom surface and two side surfaces and further comprising:

a. a first and second set of concentric vertical shafts, each of the first and second set of vertical shafts comprising a first, second, and third vertical shaft arranged concentrically, each having a top end and a bottom end, and arranged such that the second vertical shaft fits within the first vertical shaft, and may be slid up and down within the first vertical shaft, and, the third vertical shaft fits concentrically within the second vertical shaft and may be moved vertically up and down within the first and second vertical shaft, and,

b. the first vertical shaft fixedly attached to the back of the suitcase, and,

c. a handle attached to the top of each of the second vertical shafts, the handle having a button, the button attached to rods within each of the first and second sets of vertical shafts, the rod attached to spring loaded latches within each of the first and second sets of vertical shafts, the latches locking the second and third verticals shafts in each of the first and second sets of verticals shafts in place and releasing the second and third vertical within each of the first and second sets of vertical shafts when the button is pushed, and,

d. a horizontal bar attached to a bottom end of the third vertical shafts within each of the first and second sets of vertical shafts, and,

e. two lower diagonal shafts each having a first end and a second end and the first ends attached to the horizontal bar, and,

f. the second ends each attached to lever arms, the lever arms having a first end and a second end, and, the second ends of the diagonal shafts attached to the first end of the lever arms and the second end of the lever arms each attached to a horizontal shaft that is rotatably mounted to the bottom surface of the suitcase, and,

g. two wheels attached to each of the horizontal shafts, and,

h. the concentric sets of vertical shafts, the horizontal bar, the diagonal arms and the lever arms linked together, such that when the button is pushed and handle is moved upward, the lever arms are rotated in a first direction, thereby rotating the horizontal shafts, and, thereby extending the wheels, and,

i. when the button is pushed and the handle is moved downward, the lever arms are rotated in a second direction, thereby rotating the horizontal shafts, and, thereby retracting the wheels.

6. The suitcase of claim **5** further including a cover attached to the back surface of the suitcase and enclosing the sets of concentric vertical shafts, the horizontal bar, the diagonal shafts and the lever arms.

7. The suitcase of claim **5** wherein when the handle is moved to a fully upward position, and the button is released, the wheels are locked in an extended position and when the handle is moved to a fully downward position, and the button is released, the wheels are locked in a retracted position.

8. A suitcase with retractable wheels, the suitcase having a front surface, a back surface a top surface, a bottom surface and two side surfaces and further comprising:

a. a first and second set of concentric vertical shafts, each of the first and second set of vertical shafts comprising a first, second, and third vertical shaft arranged concentrically, each having a top end and a bottom end, and arranged such that the second vertical shaft fits within the first vertical shaft, and may be slid up and down within the first vertical shaft, and, the third vertical shaft fits concentrically within the second vertical shaft and may be moved vertically up and down within the first and second vertical shaft, and,

b. the first vertical shaft fixedly attached to the back of the suitcase, and,

c. a handle attached to the top of each of the second vertical shafts, the handle having a button, the button attached to rods within each of the first and second sets of vertical shafts, the rod attached to spring loaded latches within each of the first and second sets of vertical shafts, the latches locking the second and third verticals shafts in each of the first and second sets of verticals shafts in place and releasing the second and third vertical within each of the first and second sets of vertical shafts when the button is pushed, and,

d. a horizontal bar attached to a bottom end of the third vertical shafts within each of the first and second sets of vertical shafts, the vertical bar including a pin that fits within and slidably engages a slot vertical T-shaped connector wherein the pin is moved to the the top of the slot by raising the handle to a fully upward position and thereby engaging lever arms, the lever arms having a first end and a second end, and, the second ends of the second end of the lever arms each attached to a horizontal shaft that is rotatably mounted to the bottom surface of the suitcase, and,

e. two wheels attached to each of the horizontal shafts, and,

f. the concentric sets of vertical shafts, the horizontal bar, the vertical t-shaped connector and the lever arms linked together, such that when the button is pushed and handle is moved upward, the lever arms are rotated in a first direction, thereby rotating the horizontal shafts, and, thereby extending the wheels, and,

g. when the button is pushed and the handle is moved downward, the lever arms are rotated in a second direction, thereby rotating the horizontal shafts, and, thereby retracting the wheels.

9. The suitcase of claim **8** further including a cover attached to the back surface of the suitcase and enclosing the sets of concentric vertical shafts, the horizontal bar, the diagonal shafts and the lever arms.

10. The suitcase of claim **8** wherein when the handle is moved to a fully upward position, and the button is released, the wheels are locked in an extended position and when the handle is moved to a fully downward position, and the button is released, the wheels are locked in a retracted position.

11. A suitcase with retractable wheels, the suitcase having a front surface, a back surface a top surface, a bottom surface and two side surfaces and further comprising:

a. a horizontal shaft that is rotatably mounted to the bottom surface of the suitcase, and,

b. two wheels attached to each of the horizontal shafts, and,

c. a first bevel gear mounted to the horizontal shaft, and,

d. an electric motor having a shaft, and,

e. a second bevel gear attached to the shaft of the electric motor, and,

f. the first and second bevel gear engaged such that rotation of the shaft of the electric motor in a first direction causes the horizontal shaft to rotate and thereby extend the wheels from the base of the suitcase, and,

g. rotation of the shaft of the electric motor in a second direction causes the horizontal shaft to rotate and thereby retract the wheels towards the base of the suitcase.

12. The suitcase of claim **11** having a second horizontal shaft, a second electric motor, a third and fourth bevel gear and two additional wheels attached to the second horizontal shaft,

a. all arranged such that rotation of the shaft of the second electric motor in a first direction causes the second horizontal shaft to rotate and thereby extend the wheels attached to the second horizontal shaft from the base of the suitcase, and,

b. rotation of the shaft of the electric motor in a second direction causes the second horizontal shaft to rotate and thereby retract the wheels attached to the second horizontal shaft towards the base of the suitcase.

13. The suitcase of claim **12** wherein the two electric motors operate synchronously such that the first horizontal shaft and the second horizontal shaft rotate simultaneously to extend and retract all four wheels attached thereto.

14. The suitcase of claim **11** The suitcase of claim **11** having a second horizontal shaft, and, two additional wheels attached to the second horizontal shaft, and gearing and a drive belt extending from the first horizontal shaft to the second horizontal shaft such that rotation of the electric motor in a first direction causes both the first horizontal shaft and the second horizontal shaft to simultaneously rotate and extend the wheels attached to each to extend away from the base of the suitcase, and, rotation of the shaft of the electric motor in a second direction causes the first horizontal shaft and the second horizontal shaft to simultaneously rotate and

thereby retract the wheels attached to the first horizontal shaft and the second horizontal shaft towards the base of the suitcase.

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