APPARATUS FOR CONFIGURING THE INTERIOR SPACE OF A VEHICLE

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ABSTRACT
An apparatus for configuring the cargo area of a vehicle includes an expansion portion or movable cover for increasing and decreasing the cargo area upon movement between a retracted position and an extended position.
APPARATUS FOR CONFIGURING THE INTERIOR SPACE OF A VEHICLE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims benefit of U.S. Non-Provisional application Ser. No. 10/815,588, filed Apr. 1, 2004, titled Apparatus for Configuring the Interior Space of a Vehicle, which claims benefit of U.S. Provisional Application Ser. No. 60/476,155, filed Jun. 5, 2003, titled Apparatus for configuring the Interior Space of a Vehicle, the disclosures of which are expressly incorporated by reference herein.

FIELD

[0002] The present disclosure generally relates to an apparatus for configuring the cargo area of a vehicle, and more particularly to an expansion portion or adjustable cover that moves between a retracted position and an extended position to decrease and increase the cargo area, respectively.

BACKGROUND OF THE INVENTION

[0003] For a variety of reasons, many consumers desire passenger vehicles that are larger, in terms of carrying capacity and/or seating capacity, than conventional sedans. The popularity of Sport Utility Vehicles (SUVs) is evidence of this consumer desire for passenger vehicles with increased interior space. Of course, depending upon their intended use of the vehicle, some consumers desire the largest of passenger vehicles, while other consumers desire a vehicle that is larger than a conventional sedan, but smaller than the largest passenger vehicles.

[0004] Vehicle manufacturers have sought to accommodate these different preferences by providing passenger vehicles of different sizes. This approach is deficient because it requires consumers to select a vehicle having a capacity that satisfies the consumer’s primary capacity need. It is well known, however, that consumer’s periodically have need for a vehicle with a smaller or larger capacity. For example, a consumer who purchases a relatively small vehicle may, from time to time, need to carry cargo in excess of the cargo capacity of the vehicle or passengers in excess of the passenger capacity of the vehicle. Alternatively, a consumer who purchases a relatively large vehicle may, from time to time, carry substantially less cargo or substantially fewer passengers than the carrying capacity of the vehicle.

[0005] Another consideration consumers face when purchasing larger passenger vehicles is the trade-off between size (and therefore carrying capacity) and ease of parking. Some consumers may desire a vehicle having a very large carrying capacity, but not purchase such a vehicle because it will be difficult to park in public lots or garages, and/or difficult or impossible to park in the consumer’s garage. This consideration, along with the problems relating to fixed capacity passenger vehicles outlined above, clearly demonstrates a need for a passenger vehicle having a variable carrying capacity and size.

[0006] The present invention generally relates to an apparatus for configuring the cargo area of a vehicle, and more particularly to an expansion portion or adjustable cover that moves between a retracted position and an extended position to decrease and increase the cargo area, respectively.

[0007] Additionally, vehicles having cargo areas are used to haul items of a variety of different sizes. In some circumstances, it is desirable to have a cargo area of a relatively small size for carrying small items, while in other circumstances it is desirable to have a cargo area of a relatively large size for carrying large items. Conventional vehicles, such as pickup trucks, provide a fixed cargo area. Thus, consumers must choose a vehicle with a cargo area that will accommodate most cargo carrying situations, but which will be unsuited for other situations.

[0008] Moreover, users of such vehicle often desire a covered cargo area for hauling certain types of loads. Typically, a conventional pickup truck cap is attached to the bed of the vehicle to protect the contents of the cargo area. In some circumstances, however, the cap is unnecessary and/or an impediment to loading and unloading cargo into and out of the cargo area. Thus, the cap must be removed and stored for these hauling situations, then re-attached when the user desires a covered cargo area.

SUMMARY OF THE INVENTION

[0009] The present invention provides a passenger vehicle that may be configured to provide a first interior volume when an extension portion of vehicle is in a retracted position, and a second, larger interior volume when the expansion portion is in an extended position. Thus, the apparatus according to the present invention, when incorporated into a suitable passenger vehicle, permits the consumer to increase and decrease the carrying capacity (and size) of the vehicle depending upon the consumer’s current carrying and/or parking needs.

[0010] The present invention provides an expansion portion for connection to the cargo area of a vehicle which permits the user to move the expansion portion between a retracted position, wherein a relatively small cargo area is provided, and an extended position, wherein a relatively large cargo area is provided. Additionally, the present invention provides several embodiments of an adjustable cover for the cargo area of a vehicle. Depending upon the embodiment, the cover may be raised and lowered to increase and decrease the vertical dimension of the cargo area, or collapsed to provide an uncovered cargo area and extended to provide covered cargo area. In other embodiments, the present invention provides movable side walls of a cargo area to either increase and decrease the lateral dimension of the cargo area, or facilitate side loading and unloading into and out of the cargo area.

[0011] The features and advantages of the present invention described above, as well as additional features and advantages, will be readily apparent to those skilled in the art upon reference to the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a side elevation view of an apparatus according to the present invention coupled to a vehicle and in a retracted position.

[0013] FIG. 2 is a perspective view of the apparatus and vehicle of FIG. 1.

[0014] FIG. 3 is a side elevation view similar to FIG. 1, showing the apparatus in an extended position.

[0015] FIG. 4 is a perspective view similar to FIG. 2, showing the apparatus in the extended position.

[0016] FIG. 5 is a partially fragmented, top plan view of an apparatus and vehicle according to the present invention.
FIG. 6 is a side elevation view of another embodiment of an apparatus according to the present invention coupled to a vehicle and in a retracted position.

FIG. 7 is a side elevation view similar to FIG. 6, showing the apparatus in an extended position.

FIG. 8 is a partially fragmented, perspective view of another embodiment of an apparatus and vehicle according to the present invention.

FIG. 9 is a partially fragmented, side elevation view similar to FIG. 3, showing additional features of the invention.

FIGS. 10-12 are partially fragmented side elevation views similar to FIG. 3 showing various actuation and support assemblies for moving the apparatus between the retracted position and the extended position.

FIGS. 13 and 14 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 15 and 16 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 17 and 18 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 19 and 20 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIG. 21 is a partially fragmented, side elevation view of still another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 22 and 23 are partially fragmented, side elevation views of yet another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 24 and 25 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 26 and 27 are partially fragmented, side elevation views of another embodiment of an apparatus and vehicle according to the present invention.

FIG. 28 is a perspective view of another embodiment of an apparatus according to the present invention.

FIGS. 29 and 30 are partially fragmented, side elevation views of still another embodiment of an apparatus and vehicle according to the present invention.

FIGS. 31 and 32 are partially fragmented, side elevation views of yet another embodiment of an apparatus and vehicle according to the present invention.

FIG. 33 is a side elevational view of a vehicle having an expansion portion according to the present invention.

FIG. 34 is a side elevational view of the vehicle of FIG. 33 with the expansion portion in an extended position.

FIG. 35 is a side elevational view of a vehicle having two expansion portions according to the present invention.

FIG. 36 is a side plan view of the vehicle of FIG. 35 with both expansion portions in an extended position.

FIG. 37 is a perspective view of a vehicle having another embodiment of an expansion portion according to the present invention.

FIG. 38 is a perspective view of the vehicle of FIG. 37 with the expansion portion in an extended position.

FIG. 39 is a perspective view of a vehicle having another embodiment of an expansion portion according to the present invention.

FIG. 40 is a perspective view of the vehicle of FIG. 39 with the expansion portion in an extended position.

FIG. 41 is a perspective view of a vehicle having an adjustable cover according to the present invention.

FIG. 42 is a perspective view of the vehicle of FIG. 41 with the adjustable cover in an extended position.

FIG. 43 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 44 is a perspective view of the vehicle of FIG. 43 with the adjustable cover in an extended position.

FIG. 45 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 46 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 47 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 48 is a perspective view of the vehicle of FIG. 47 with the adjustable cover in an extended position.

FIG. 49 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 50 is a perspective view of the vehicle of FIG. 49 with the adjustable cover in an extended position.

FIG. 51 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 52 is a perspective view of the vehicle of FIG. 51 with the adjustable cover in an extended position.

FIG. 53 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 54 is a perspective view of the vehicle of FIG. 53 with the adjustable cover in an intermediate position.

FIG. 55 is a perspective view of the vehicle of FIG. 54 with the adjustable cover in an extended position.

FIG. 56 is a perspective view of a vehicle having another embodiment of an adjustable cover according to the present invention.

FIG. 57 is a perspective view of the vehicle of FIG. 56 with the adjustable cover in an extended position.

FIG. 58 is a perspective view of a vehicle having an apparatus for configuring a cargo area according to the present invention.

FIG. 59 is a perspective view of the vehicle of FIG. 58 with the apparatus in an extended position.

FIG. 60 is a perspective view of a vehicle having an apparatus for configuring a cargo area according to the present invention.

FIG. 61 is a perspective view of the vehicle of FIG. 60 with the apparatus in an extended position.

FIG. 62 is a perspective view of a vehicle having a movable floor portion according to the present invention.

FIG. 63 is a perspective view of the vehicle of FIG. 62 with the floor portion in an intermediate position.

FIG. 64 is a perspective view of the vehicle of FIG. 62 with the floor portion in an extended position.

FIG. 65 is a perspective view of a vehicle having a movable floor portion of FIGS. 62-64 and another embodiment of an apparatus for configuring the cargo area of the vehicle.
FIG. 66 is a perspective view of the vehicle of FIG. 65 with the floor portion in an intermediate position and the apparatus in an extended position.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The embodiments described below are merely exemplary and are not intended to limit the invention to the precise forms disclosed. Instead, the embodiments were selected for description to enable one of ordinary skill in the art to practice the invention.

FIGS. 1 and 2 depict a passenger vehicle 10 equipped with one embodiment of an expansion portion 12 according to the present invention. In addition to the description provided herein, various features of the invention disclosed in U.S. Provisional Patent Application Ser. No. 60/476,257 entitled “Apparatus for Configuring the Cargo Area of a Vehicle,” filed Jun. 5, 2003, may readily be incorporated into the embodiments of the present invention. Accordingly, this application is hereby expressly incorporated herein by reference. As will become apparent from the following description, vehicle 10 may be any of a large variety of different categories of passenger and cargo vehicles including, for example and without limitation, cargo vans, mini vans, full size vans, SUVs, cross-over vehicles, pick-up trucks, limousines and other similar types of vehicles. Vehicle 10 generally includes a body 14 mounted on a frame 16 (FIG. 9) to which wheels 18 are attached. Body 14 includes, among other things, a roof 20, a floor 22 (FIG. 5), a first side 24, a second side 26, and a back end 28 that together define an interior space 30 (FIG. 5). Since first side 24 is essentially identical to second side 26, only first side 24 is described in detail. First side 24 generally includes a first door 32, a second door 34, and a rear panel 36 defining a wheel well 38 and including a window 40. Rear panels 36, roof 20, and floor 22 each include an edge 42 that defines an opening 44 (FIG. 5) at back end 28 of vehicle 10.

As best shown in FIGS. 3 and 4, expansion portion 12 generally includes a rear wall 46 configured generally to conform to edge 42 of vehicle 10 as will be further described below. Expansion portion 12 also includes an upper wall 48, side walls 50, 52, and a lower wall 55. Rear wall 46 generally includes a perimeter 53 and a bumper portion 54. In the embodiment shown in FIGS. 1-4, rear wall 46 further includes a window 56 and a door 58. Various configurations of rear wall windows and doors may readily be adapted by one of ordinary skill in the art for use with any of the embodiments of the present invention described herein. For example, door 58 may be a rear lift gate door type such that both door 58 and window 56 pivot about a hinge or hinges situated along an upper edge of rear wall 46. Window 56 may be a hatch window that pivots open relative to door 58 or an integrated window that is fixed relative to door 58 or extends into door 58 and retracts from door 58 during opening and closing, respectively. Alternatively, window 56 may be a hatch type window, while door 58 is a full swinging tail gate type door or a drop down tail gate type door. Moreover, door 58 and window 56 may be replaced with split, swing-out rear cargo doors each including a separate functional or non-functional window. Any of these various rear door configurations and any other similar configurations may be used consistent with the teachings of the present invention. Rear wall 46 may further include a windshield wiper 60 attached to door 58, and tail lights 62 positioned along perimeter 53.

Side walls 50, 52 may include respective side windows 64, 66. As will be further described below, side windows 64, 66 may be fixed windows, pivoting vent windows, or fully functional windows.

Referring again to FIGS. 1 and 2, vehicle 10 is shown with expansion portion 12 in a retracted position. In the retracted position, perimeter 53 mates with edge 42 and, through use of a sealing material as further described below, substantially seals interior space 30 of vehicle 10. In this embodiment, side walls 50, 52, lower wall 55, and upper wall 48 are situated within interior space 30 of vehicle 10 when expansion portion 12 is in the retracted position. Additionally, side windows 64, 66 of side walls 50, 52, respectively, may be positioned such that side windows 64, 66 are aligned with windows 40 of rear panels 36. As such, occupants of vehicle 10, for example, may view objects either through window 40, or through the combination of window 40 and side windows 64, 66. It should be understood that when expansion portion 12 is in the retracted position, both the length of vehicle 10 and the volume of interior space 30 are at minimum values.

Referring now to FIGS. 3 and 4, expansion portion 12 is shown in its extended position. As will be further described below, a variety of different support and actuation mechanisms may be used to move expansion portion 12 between the retracted and extended positions. Also, it should be understood that any of a variety of different safety features may be incorporated with the teachings of the present invention to prevent or reduce the likelihood of injury from pinch points created as expansion portion 12 is moved between the extended and retracted positions. In the embodiment shown, expansion portion 12 is moved from the retracted position to the extended position by driving expansion portion 12 in a rearward direction relative to the front of vehicle 10 along an axis (designated A in FIG. 3) which is substantially parallel to a longitudinal axis of vehicle 10. When expansion portion 12 reaches the fully extended position shown in FIGS. 3 and 4, portions of expansion portion 12 mate with interior surfaces of vehicle 10 to seal interior space 30 as is further described below. As should be understood from the foregoing, when expansion portion 12 is in the extended position, both the length of vehicle 10 and the volume of interior space 30 are at maximum values. It should be further understood that expansion portion 12 may have a variety of predefined intermediate positions between the retracted position and the extended position such that a particular vehicle length and interior volume may be selected by the user. Alternatively, the position of expansion portion 12 relative to vehicle 10 may be infinitely adjustable between retracted position and the extended position.

As should further be understood that wiring and plumbing to the various components of expansion portion 12 must be configured to accommodate movement of expansion portion 12 between the retracted and extended positions. Moreover, the support and actuation mechanisms for expansion portion 12 should be configured such that rear wall 46 and bumper portion 54 meet or exceed any required safety standards for rear-end collisions. As shown in FIGS. 3 and 4, when expansion portion 12 is in the extended position, lower wall 55, side walls 50, 52, and upper wall 48 are exposed, and form a portion the exterior of vehicle 10. Moreover, side windows 64, 66 of side walls 50, 52, respectively, are exposed, thereby providing additional light to interior space 30 as well as additional viewing area into and out of vehicle 10.
As should be apparent from the foregoing, expansion portion 12 may be moved to the extended position to increase interior space 30, thereby increasing the cargo area of vehicle 10 and/or the passenger area of vehicle 10. For example, the length of vehicle 10 may correspond to a full size SUV (e.g., approximately 16 feet) when expansion portion 12 is in the retracted position, thereby permitting the owner of vehicle 10 to park vehicle 10 in a garage having a standard depth of, for example, 20 feet. In such an example, approximately four feet of clearance is available either around the front, the rear, or the front and the rear of vehicle 10 when parked in such a conventional garage. When expansion portion 12 is moved to the extended position, the length of vehicle 10 may correspond to a large SUV (e.g., approximately 18 feet), thereby increasing the seating and/or cargo capacity of vehicle 10. After using vehicle 10 with the expansion portion 12 in the extended position, the owner of vehicle 10 may simply retract expansion portion 12 to the retracted position for parking in a standard depth garage, thereby maintaining adequate clearance around vehicle 10. Alternatively, a large SUV equipped with expansion portion 12 may be parked in a convention garage with minimal clearance (e.g., 2 feet) and expanded during use by extending expansion portion 12 to an overall length that would not permit storage of vehicle 10 in a convention garage. Of course, it should be understood that vehicles having a length that exceeds the depth of a convention garage may also include expansion portion 12 to permit further extension of the vehicle and consequent increases in length and interior space 30.

FIG. 5 depicts additional details of vehicle 10 and expansion portion 12. More particularly, each of side walls 50, 52 are shown as including an inner-engagement surface 21 and an outer engagement surface 23. Additionally, side panels 36 are shown as including an inner perimeter seal that extends substantially around the perimeter of opening 44, and an outer perimeter seal mounted adjacent edge 42, also extending substantially around the perimeter of opening 44. As suggested by FIG. 5, inner engagement surface 21 engages inner perimeter seal 25 when expansion portion 12 is moved to the extended position. Similarly, outer engagement surface 23 engages outer perimeter seal 27 when expansion portion 12 is moved to the retracted position, thereby sealing interior space 30 of vehicle 10. It should also be noted that outer engagement surface 23 may be formed as a curved surfaces (as shown in FIG. 5) as opposed to a stepped surface or should improve the aesthetics and aerodynamics of vehicle 10 while traveling with expansion portion 12 in the extended position.

FIGS. 6 and 7 show an alternate embodiment of the present invention. Since various components of the embodiments described herein, including components of the embodiment of FIGS. 6 and 7, are substantially identical to corresponding components in the previous figures, the same reference designations will be used. The embodiment of FIGS. 6 and 7 is different from the previously described embodiment primarily in that side walls 50, 52 and upper wall 48 of expansion portion 12 substantially enclose portions of rear panels 36 and roof 20, instead of being substantially enclosed by those portions of vehicle 10. More specifically, expansion portion 12 includes side walls 50, 52 and upper wall 48 which have exterior surfaces that are substantially continuous with corresponding exterior surfaces of rear panels 36A and roof 20A when expansion portion 12 is in the retracted position shown in FIG. 6. When expansion portion 12 is moved to the extended position shown in FIG. 7, expansion portion 12 reveals rear panel inner portions 36B and roof inner portion 20B. Additionally, window portions 40B of rear panel inner portions 36B are exposed to the exterior of vehicle 10. When expansion portion 12 is in the extended position, an inner flange (not shown) extending substantially around the entire perimeter of edge 68 of side walls 50, 52 and upper wall 48 forms a seal with a perimeter flange formed on corresponding components of vehicle 10. When expansion portion 12 is in the retracted position of FIG. 6, the inner flange (not shown) adjacent edge 68 of expansion portion 12 forms a seal with edge 42, rear panels 36A and roof 20A. Additionally, side windows 64, 66 of side walls 50, 52, respectively, substantially align with window portions 40B of rear panel inner portions 36B.

FIG. 7 shows another embodiment of an expansion portion 12 according to the present invention. In this embodiment, expansion portion 12 fits substantially between a double walled portion of the rear of vehicle 10. More particularly, roof 20 of vehicle 10 includes an outer shell 70 and an inner shell 72. Similarly, rear panels 36 include outer panels 74 and inner panels 76. A gap 78 is formed between outer panels 74 and inner panels 76 and outer shell 70 and inner shell 72. Outer panels 74 include outer windows 73, and inner panels 76 include inner windows 75.

Expansion portion 12 includes side walls 50, 52 and upper wall 48. Side walls 50, 52 define side windows 64, 66. Edge 68 of expansion portion 12 includes a flange 80 that extends substantially along the entire height of side walls 50, 52 and the entire width of upper wall 48. Expansion portion 12 further includes lower wall 55. Lower wall 55 includes outer edges 82 which are spaced apart from inner surfaces of side walls 50, 52 to form slots 84. As should be apparent from the drawing, slots 84 are wide enough to receive the thickness of inner panels 76 of rear panels 36 as expansion portion 12 is moved between the extended and retracted positions. When in the retracted position, flange 80 sealed against internal surfaces (not shown) of rear panels 36 and side windows 64, 66 are aligned between outer windows 73 and inner windows 75. Lower wall 55 is situated above floor 22 of vehicle 10. When expansion portion 12 is moved to the extended position, flange 80 sealed against other internal surfaces (not shown) of side panels 36 and roof 20, and side windows 64, 66 are exposed to the exterior of vehicle 10. In this manner, the length and interior space 30 of vehicle 10 is increased. It should be understood that a rear sunroof may readily be incorporated into upper wall 48 of expansion portion 12.

Referring now to FIG. 8, vehicle 10 is shown with expansion portion 12 in the extended position, but with certain portions of vehicle 10 and expansion portion 12 removed for clarity. In this embodiment, expansion portion 12 is moved between the retracted and extended positions manually. As shown, roof 20 includes an end section 88 having a downwardly facing ridge 90, a forward seal 92 which may be continuous with or a part of inner perimeter seal 25 (FIG. 5), and a rearward seal 94 which may be continuous with or a part of outer perimeter seal 27 (FIG. 5). Upper wall 48 of expansion portion 12 includes a forward ridge 96 and a rearward ridge 98, which may be formed substantially continuously with inner engagement surface 21 and outer engagement surface 23 of FIG. 5, respectively. Similarly, frame 16 includes an end section 100 with a forward seal 102 and a rearward seal 104 attached thereto. Lower wall 55 of expansion portion 12 includes, in addition to bumper portion 54, a
forward portion 106 including an engagement surface 108, and a rearward portion 110 including an engagement surface 112. Also shown in FIG. 9 is a rear door hinge 114 and a hatch hinge 116 connected to perimeter 53 for use in opening door 58 (a lift gate style door) and window 56 (a separately moveable hatch window), respectively.

[0080] When expansion portion 12 is in the extended position as shown in FIG. 9, forward ridge 96 of upper wall 48 seals against forward seal 92 of end section 88 and engagement surface 108 of lower wall 55 seals against forward seal 102 of end section 100. Like outer engagement surfaces 23 of side walls 50, 52, rearward ridge 98 may be aerodynamically shaped. When expansion portion 12 is moved to the retracted position, rearward ridge 98 seals against rearward seal 94 of end section 88 and engagement surface 112 seals against rearward seal 104 of end section 100. It should be understood that many of a variety of different types of locking mechanisms may be used to secure expansion portion 12 in the retracted and/or extended position. Additionally, expansion portion 12 may include a handle which is either separate from or integral with a locking mechanism for moving expansion portion 12 between the extended and retracted positions. Alternatively, a crank or other manually actuated mechanism may be used to move expansion portion 12 between the extended and retracted positions.

[0081] FIG. 10 shows an alternate embodiment of an expansion portion 12 according to the present invention. The embodiment of FIG. 10 is identical to that shown in FIG. 9 except that an automatic actuation and support assembly 120 is shown attached to vehicle 10 and expansion portion 12. It should be understood that any of the variations of assembly 120 described herein may be used with any of the embodiments of expansion portion 12 described herein. Assembly 120 generally includes a housing 122 mounted to vehicle frame 16, a moveable member 124 sized to be received, for example, telescopically within housing 122, and a bracket 126 connected to a free end 128 of moveable member 124 and bumper portion 54 of expansion portion 12. In the depicted embodiment, moveable member 124 is telescopically received within housing 122 to move expansion portion 12 into the retracted position. Moveable member 124 may then be extended from housing 122 to move expansion portion 12 to the extended position as shown in FIG. 10.

[0082] It should be understood that a variety of different variations of assembly 120 may be readily employed to perform the functions of moving expansion portion 12 between the extended and retracted positions, and supporting expansion portion 12 when in the extended position. For example, two or more assemblies 120 may be connected to frame 16 below expansion portion 12 in spaced apart relationship to one another and configured to move in a synchronized fashion. Housing 122 may be cylindrical or have a rectangular or other cross section. Moveable member 124 may likewise have a variety of different shapes, be formed from a solid material or a material having a hollow cross-sectional area. Moreover, moveable member 124 may be configured to move over a rail mounted to frame 16, as opposed to moving into and out of housing 122. Finally, any of a plurality of different drive technologies may be employed to move moveable member 124 between the extended and retracted positions. For example, moveable member 124 may be moved by a hydraulic drive, a pneumatic drive, or by electrical motors connected to a rack and pinion drive, a chain drive, or a worm screw drive mechanism. Other suitable technologies exist.

[0083] Referring now to FIG. 11, an expansion portion 12 is shown connected to a plurality of assemblies 120 which are mounted within rear panels 36. More specifically, a pair of assemblies 120 are mounted in a substantially parallel, vertically spaced relationship within each of rear panels 36 of vehicle 10. Each assembly 120 includes a housing 122 mounted within rear panel 36, and a moveable portion 124 mounted within an opening formed in a respective side wall 50, 52 of expansion portion 12. The use of four assemblies 120, and particularly the two upper assemblies 120 connected to expansion portion 12 at a substantial distance above lower wall 55, may provide additional support of expansion portion 12 when in the extended position.

[0084] FIG. 12 illustrates an alternative embodiment of an assembly 120, wherein a single assembly 120 is mounted within each of rear panels 36 of vehicle 10. In this embodiment, housing 122 and moveable member 124 of assemblies 120 are spaced at a substantial distance above lower wall 55 of expansion portion 12. Additionally, each of housings 122 and moveable members 124 have a vertical dimension (as viewed in FIG. 12) that is greater than a width dimension (into and out of the page as viewed in FIG. 12). The relatively small width dimension permits assemblies 120 to fit within the interior space of rear panels 36 and side walls 50, 52 while the relatively large vertical dimension may provide additional stability and support for expansion portion 12 when in the extended position.

[0085] FIGS. 13-28 depict various seating arrangements and other internal features of vehicle 10 and expansion portion 12. It should be understood that any of the various embodiments of expansion portion 12 described herein, as well as any of the various actuation and support assemblies 120 described herein, may be used in conjunction with the alternative configurations depicted in FIGS. 13-28.

[0086] Referring now to FIGS. 13 and 14, expansion portion 12 is shown having a third row seat 130 mounted to lower wall 55. This embodiment should be contrasted with, for example, the embodiment depicted in FIG. 9 wherein third row seat 130 is mounted to floor 22 of vehicle 10. It should be understood that, in any of the embodiments described herein, reference to a "seat" is intended to refer to a single seat and two or more seats aligned in a row of any type, style, or configuration. Third row seat 130 is mounted on lower wall 55 such that the back 132 is spaced apart from rear wall 46 of expansion portion 12 to provide a space 134 between back 132 and rear wall 46 for storage. When expansion portion 12 is in the retracted position as shown in FIG. 13, the distance between back 132 of third row seat 130 and the back 136 of second row seat 138 is distance B. As shown in FIG. 14, when expansion portion 12 is moved to the extended position, the distance between back 132 and back 136 is increased to distance C.

[0087] The configuration of expansion portion 12 in vehicle 10 depicted in FIGS. 15 and 16 is substantially similar to that depicted in FIGS. 13 and 14. In FIGS. 15 and 16, however, second row seat 138 is mounted to floor 22 of vehicle 10 in a rearward facing orientation. It should be understood, however, that second row seat 138, as well as any other seat described herein, may be moveably mounted to floor 22 (or lower wall 55) such that seat 138 can swivel between a forward facing orientation and a rearward orientation or be adjusted between these orientations by employing the teachings of U.S. Provisional Patent Application Ser. No. 60/480,204 entitled "Vehicle Seat." Additionally, the embodi-
ment of FIGS. 15 and 16 includes a table assembly 140 mounted to rear panel 36 of vehicle 10. It should also be understood that a single table assembly 140 may be mounted to one rear panel 36 or a table assembly 140 may be mounted to both rear panels 36. Table assembly 140 includes a table top 142, a bracket 144, and a support 146. Top 142 may be pivotally mounted on one edge of rear panel 36 such that top 142, when in the stowed position shown in FIG. 15, is supported in substantially parallel relationship to rear panel 36. When expansion portion 12 is moved to the extended position shown in FIG. 16, top 142 may be pivoted upwardly into substantially perpendicular relationship with rear panel 36. Support 146 may be configured to retract within bracket 144 or both bracket 144 and rear panel 36 when table top 142 is in the stowed position, and to automatically latch in the orientation shown in FIG. 16 when table top 142 is in the in-use position, thereby supporting table top 142. As shown in FIG. 16, occupants of second row seat 138 and third row seat 130 have simultaneous access to table assembly 140 when expansion portion 12 is in the extended position and table assembly 140 is in the in-use position.

[0088] The embodiment of expansion portion 12 shown in FIG. 17 is substantially similar to the embodiment shown in FIG. 13 except that third row seat 130 is mounted to lower wall 55 such that back 132 is substantially adjacent rear wall 46 of expansion portion 12. Consequently, the length of lower wall 55 of the embodiment of FIG. 17 may be less than the length of lower wall 55 of the embodiment of FIG. 13. Although, in the embodiment of FIG. 17, space 134 between rear wall 46 and back 132 of third row seat 130 is substantially unavailable, the distance between back 136 of second row seat 138 and back 132 of third row seat 130 is a distance D that is larger than the corresponding distance B of the embodiment of FIG. 13. Of course, when expansion portion 12 is moved to the extended position (not shown), the distance between back 136 and back 132 is also greater than distance C shown in FIG. 14.

[0089] Referring now to FIGS. 18 and 19, another embodiment of expansion portion 12 is shown. This embodiment differs from the embodiment of FIG. 13 in that third row seat 130 is positioned in a rearward facing orientation and the length of lower wall 55 is extended farther over floor 22 of vehicle 10. Lower wall 55 is extended to provide leg room of the occupants of third row seat 130. When expansion portion 12 is moved to the extended position of FIG. 19, space 150 between back 132 of third row seat 130 and back 136 of second row seat 138 is increased. Increased space 150 may be used for additional storage, or back 132 of third row seat 130 may be folded flat to provide a substantially horizontal resting or sleeping surface for the occupant or occupants of third row seat 130.

[0090] In FIGS. 20 and 21, expansion portion 12 is configured with a fourth row seat 152 mounted to lower wall 55 such that back 154 of fourth row seat 152 is substantially adjacent to rear wall 46 of expansion portion 12. When expansion portion 12 is in the retracted position shown in FIG. 20, objects may be stored on top of fourth row seat 152 behind back 132 of third row seat 130. When expansion portion 12 is in the extended position shown in FIG. 21, the increased distance between third row seat 130 and fourth row seat 152 provides sufficient leg room for occupants of fourth row seat 152.

[0091] The embodiment of expansion portion 12 depicted in FIGS. 22 and 23 differs from the embodiment depicted in FIGS. 20 and 21 in that fourth row seat 152 is replaced with jumper seat 156. Jumper seat 156 includes a back 158, which is attached to rear wall 46 of expansion portion 12. It should be understood that jumper seat 156 may be used with any of the various door and window configurations of rear wall 46 described herein. Jumper seat 156 further includes a seat portion 160, which is pivoted to attachment back 158 for movement between a stowed position depicted in FIG. 22 and an in-use position depicted in FIG. 23. When expansion portion 12 is in the retracted position and jumper seat 156 is in the stowed position shown in FIG. 22, storage space is available below jumper seat 156 and between jumper seat 156 and back 132 of third row seat 130. When expansion portion 12 is moved to the extended position shown in FIG. 23, seat portion 160 of jumper seat 156 may be moved to the in-use position. The additionally space provided between jumper seat 156 and third row seat 130 when expansion portion 12 is moved to the extended position may then be used as leg room for occupants of jumper seat 156. Alternatively, seat portion 160 of jumper seat 156 may remain in the stowed position and the increased space may be used for additional storage.

[0092] FIGS. 24 and 25 shown another alternative configuration of the present invention wherein jumper seat 156 is attached to back 132 of third row seat 130. In this embodiment, jumper seat 156 shares head rest 131 of third row seat 130, and remains in a fixed position relative to third row seat 130 as expansion portion 12 is moved between the retracted position and the extended position. Otherwise, jumper seat 156 is substantially identical to jumper seat 156 of FIGS. 22 and 23.

[0093] The embodiment of FIGS. 26 and 27 differs from the embodiment of FIGS. 12 and 13 in that second row seat 138 is mounted to a substantially elongated lower wall 55 of expansion portion 12, and a table assembly 162 is mounted to first row seat 164. When expansion portion 12 is in the retracted position shown in FIG. 26, the distance between the back 166 of first row seat 164 and back 136 of second row seat 138 is depicted as distance E. When expansion portion 12 is moved to the extended position of FIG. 27, the distance between back 166 and back 136 is increased to distance F. The distance between back 136 of second row seat 138 and back 132 of third row seat 130 remains substantially fixed as expansion portion 12 is moved in the extended and retracted position. Of course, in any of the embodiments described herein, any of the seats may include conventional adjustment mechanisms for forward and rearward seat adjustment.

[0094] As best shown in FIG. 27, a table assembly 162 includes a table top 168, that is pivoted mounted to back 166 for movement between a stowed position, wherein table top 168 is positioned at an angle relative to back 166 of first row seat 164, and an in-use position wherein table top 168 is substantially parallel to back 166 of first row seat 164. Table assembly 162 further includes a support 170 which is collapsible or otherwise retractable to accommodate positioning of table top 168 in the stowed position, and extendable to support table top 168 in the in-use position. It should be understood that support 170 may include a manual or automatic locking mechanism to retain table top 168 in the in-use position and a release mechanism to permit movement of table top 168 from the in-use position to the stowed position.

[0095] It should also be understood that lower wall 55 in the embodiment of FIGS. 26 and 27 may be of the extended version type depicted in broken lines in FIG. 5 such that the forward portion of lower wall 55 has a reduced width relative to the rearward portion of lower wall 55 to move between
wheel wells 38. This configuration of lower wall 55, as compared to a lower wall 55 that only extends to wheel wells 38, permits increased travel of expansion portion 12, and therefore greater adjustment of the interior volume of vehicle 10. Of course, side walls 50, 52 and upper wall 48 must also be extended if the increased travel provided by an extended lower wall 55 is used to facilitate greater extension of expansion portion 12 from vehicle 10.

[0096] FIG. 28 depicts still another embodiment of an expansion portion 12 according to the present invention. Expansion portion 12 of FIG. 28 also includes an elongated lower wall 55 on which is mounted second row seat 130, and fourth row seat 154. Except for the provision of fourth row seat 154, the embodiment of FIG. 28 is substantially identical to the embodiment of FIGS. 25 and 27.

[0097] FIGS. 29 and 30 depict an alternative embodiment of an expansion portion 12 according to the present invention. As shown, expansion portion 12 is adapted to configure the interior space of an extended cab pick-up vehicle 10. In the embodiment shown in FIGS. 29 and 30, expansion portion 12 includes a rear wall 46, an upper wall 48 (FIG. 30), side walls 50, 52 (FIG. 30) having side windows 64, 66 (FIG. 30), respectively, and a lower wall 55 (not shown). It should be understood that lower wall 55 may have a second row seat (not shown) mounted thereon which moves with expansion portion 12 as expansion portion 12 is moved between the retracted position (FIG. 29) and the extended position (FIG. 30). Alternatively, the second row seat may be mounted to floor 22 of vehicle 10 and movement of expansion portion 12 to the extended position may simply provide increased interior cargo space behind the second row seat. In yet another alternative, lower wall 55 of expansion portion 12 lies in substantially the same plane as the upper edge of the bed of vehicle 10. In such embodiment, second row seats are not included in the space within expansion portion 12, which essentially defines an enclosed shelf within the cab of vehicle 10. Thus, when in the retracted position of FIG. 29, an enclosed shelf having a first interior volume is provided which also provides a protective overhang or cover over a forwardmost portion of the vehicle bed. When expansion portion 12 is moved to the extended position of FIG. 30, the interior volume of the enclosed shelf area is increased, and the covered portion of the vehicle bed is increased.

[0098] As should be apparent from the drawings, in any of the above embodiments, side windows 64, 66 of side walls 50, 52 are substantially aligned with windows 40 of rear panels 36 when expansion portion 12 is in the retracted position. When expansion portion 12 is in the extended position, side windows 64, 66 are exposed, thereby increasing the window area of the vehicle cab. As should also be apparent from the drawings, in the embodiment of FIGS. 29 and 30, expansion portion 12 is configured such that upper wall 48, side walls 50, 52, and lower wall 55 of expansion portion 12 fit substantially within roof 20, side panels 36, and floor 22 of vehicle 10, respectively, when expansion portion 12 is in the retracted position.

[0099] Referring now to FIGS. 31 and 32, an alternative embodiment of expansion portion 12 is shown for extended cab pick-up vehicle 10. In this embodiment, expansion portion 12 may include all of the characteristics described above with regard to any of the other embodiments. The embodiment of FIGS. 31 and 32 differs from the embodiment of FIGS. 29 and 30 in that side walls 50, 52 and upper wall 48 of expansion portion 12 are configured to fit over portions of rear panels 36 and roof 20 of vehicle 10 when expansion portion 12 is in the retracted position (FIG. 31). When expansion portion 12 is moved to the extended position (FIG. 32), portions of side panels 36 including windows 40 and roof portion 203 are exposed to the exterior of vehicle 10.

[0100] FIGS. 33-36 depict a vehicle 10 having an expansion portion 12 according to one embodiment of the present invention for providing an adjustable cargo area. While vehicle 10 may be any of a large variety of different types of vehicles having cargo areas, vehicle 10 is depicted and described herein as a pick-up truck. Vehicle 10 generally includes a body 4 mounted to a frame (not shown) having wheels 18 connected thereto. Body 4 includes a cab 19 having a roof 20, a floor (not shown), a first side 24, a second side 26, and a back end 28. Roof 20, the floor, and sides 24, 26 define an interior space 30. Since first side 24 is substantially identical to second side 26, only first side 24 will be described herein. First side 24 includes, in this embodiment, a first door 32 and a second door 34. Second door 34 includes a window 40 and defines, with roof 20, an edge 42 as will be further described below.

[0101] Body 4 further includes a bed 39 connected to cab 19. Bed 39 includes a pair of side walls 45, 47, and a floor 49. Each side wall 45, 47 includes an upper edge 51, a rearward edge 270, and a wheel well 272. Side walls 45, 47 and floor 49 are configured to receive expansion portion 12.

[0102] Expansion portion 12 includes a rear wall 57, side walls 59, and a lower wall 63. Rear wall 57 includes an upper edge 65, a tailgate 67 and a bumper section 69. Of course, instead of tailgate 67, rear wall 57 may include a full or partial swinging gate, or any other type of door opening to the cargo area. In the depicted embodiment, side walls 59, 61 each include an outer panel 71 and an inner panel 274 having a substantially continuous upper edge 276.

[0103] As best shown in FIG. 33, when expansion portion 12 is in the retracted position, outer panels 71 of side walls 59 form a substantially continuous surface with bed side walls 45, 47, respectively. Outer panels 71 engage side walls 45, 47 along rearward edges 270. Upper edge 65 of rear wall 57 is also substantially continuous with upper edge 51 of bed side walls 45, 47. When expansion portion 12 is in the retracted position, expansion portion 12, bed 39, and back end 28 of cab 19 define a first cargo area. As will be apparent from the following description, when expansion portion 12 is in the retracted position, both the length of vehicle 10 (referenced by the letter “A”) and the defined cargo area are at minimum values.

[0104] Referring now to FIG. 34, when expansion portion 12 is moved to the extended position, inner panels 274 of side walls 59 extend from bed side walls 45, 47 and lower wall 63 extends from bed floor 49. When expansion portion 12 is in the extended position, expansion portion 12, bed 39, and back end 28 of cab 19 define a second cargo area that is larger than the first cargo area. Moreover, the defined cargo area of vehicle 10 is at a maximum value, and the length of vehicle 10 is expanded to length “B.” It should be understood, however, that expansion portion 12 may be configured such that its position relative to bed 19 is infinitely adjustable between the retracted position and the extended position.

[0105] In the embodiment shown, side walls 59 are positioned between bed side walls 45, 47 when expansion portion 12 is in the retracted position. It should be understood, however, that side walls 59 and bed side walls 45, 47 may be configured such that side walls 59 are positioned within side
wheels 45, 47 or outside side walls 45, 47 when expansion portion 12 is in the retracted position in the manner taught in U.S. Provisional Patent Application Ser. No. 60/476,155 entitled “Apparatus for Configuring the Interior Space of a Vehicle,” filed Jun. 5, 2003 (hereinafter, “the Interior Space Application”), the entire disclosure of which is hereby expressly incorporated herein by reference. It should also be understood that lower wall 63 of expansion portion 12 and bed floor 49 may be configured such that lower wall 63 moves under or within bed floor 49 as expansion portion 12 is moved between the retracted position and the extended position. Moreover, the engagement surfaces between bed 39 and expansion portion 12 when expansion portion 12 is in either the retracted position or the extended position may include components for forming a seal (such as those described in the Interior Space Application) to prevent leaks from the cargo area through the sides or bottom of bed 39.

[0106] Additionally, a variety of different support and actuation mechanisms may be used to move expansion portion 12 between the retracted position and the extended position as described in the Interior Space Application. Finally, it should be understood that wiring to the various components of expansion portion 12 must be configured to accommodate movement of expansion portion 12.

[0107] As should be apparent from the foregoing, expansion portion 12 may be moved to the extended position to increase the cargo carrying capacity of vehicle 10, and then retracted to the retracted position to reduce the cargo carrying capacity and to permit easier parking of vehicle 10 in, for example, a garage having a conventional depth.

[0108] In another embodiment, vehicle 10 may further include an auxiliary expansion portion 12′ as shown in FIGS. 35 and 36. Any of the expansion portion features described in the Interior Space Application may readily be incorporated into auxiliary expansion portion 12′. Auxiliary expansion portion 12′ includes a rear wall 57′, a pair of side walls 59′, a lower wall 63′, and an upper wall 77′. Each side wall 59′ is shown as including a window 79′. In the embodiment shown, auxiliary expansion portion 12′ is rigidly connected to bed 39 and movably connected to cab 19. More particularly, when in the retracted position (FIGS. 33 and 34), auxiliary expansion portion 12′ is retracted substantially within cab 19, with rear wall 57′ sealing against rear edge 42′ of roof 20 and second doors 34 to form a first interior space of cab 19. Additionally, windows 79′ of side walls 59′ are substantially aligned with windows 40 of second doors 34. When moved to the extended position (FIGS. 35 and 36), auxiliary expansion portion 12′, bed 29, and expansion portion 12′, are spaced away from cab 19 to reveal upper wall 77′, side walls 59′, and lower wall 63′. It should be understood that when auxiliary expansion portion 12′ is in the extended position, portions of upper wall 77′, side walls 59′, and lower wall 63′ seal against surfaces of cab 19 to define a second interior space of cab 19, which is larger than the first interior space. Windows 79′ of side walls 59′ are also exposed, thereby increasing the window area of cab 19. Additionally, the length of vehicle 10 is increased from length A (FIG. 33) to length C (FIG. 35). As shown in FIG. 36, the length of vehicle 10 (as well as the cargo area of bed 39) may be further increased to length D by moving expansion portion 12 to the extended position as described above.

[0109] As should be apparent from the figures, movement of auxiliary expansion portion 12′ from the retracted position to the extended position also increases the wheelbase of vehicle 10 from wheelbase E shown in FIGS. 33 and 34 to wheelbase F shown in FIGS. 35 and 36. Accordingly, the frame of vehicle 10 (as well as the drive train, and wiring and plumbing extending from the forward portion of vehicle 10 to the rearward portion of vehicle 10) should be configured to expand and retract.

[0110] FIGS. 37 and 38 show an alternative embodiment of an apparatus for configuring the cargo area of a vehicle. It should be noted that in this embodiment, and many that follow, rear wall 57′ and tailgate 67′ are not shown for clarity. In this embodiment, expansion portion 12′ is shown mounted to back end 28′ of cab 19. Expansion portion 12′ includes a rear wall 81′ having a window 83′ and a plurality of telescopic side sections 85′-a→. As best shown in FIG. 37, when expansion portion 12′ is in the retracted position, sections 85′-a→-c telescopic within one another and within section 85′-d′ and rear wall 81′ is substantially planar with a rearward edge 86′ of telescopic section 85′-d′. In this retracted position, expansion portion 12′, along with the other components of bed 39, define a first cargo area. Additionally, expansion portion 12′, along with additional components of cab 19, define a first interior space of cab 19. When expansion portion 12′ is moved along the longitudinal axis X of vehicle 10 to the extended position shown in FIG. 38, telescopic section 85′-a→-d extend relative to one another and rear wall 81′ is moved toward wheel wells 272′ of bed 39. In the extended position, rear wall 81′ of expansion portion 12′, along with other components of bed 39, define a second cargo area that is smaller than the first cargo area shown in FIG. 37. Additionally, expansion portion 12′, along with additional components of cab 19, define a second interior space of cab 19 that is larger than the first interior space shown in FIG. 37.

[0111] Any of a variety of different actuation mechanisms may be used to move expansion portion 12 between the extended position and the retracted position (or any position therebetween). Such actuation mechanisms may be configured to provide sufficient force to move, not only expansion portion 12 to the extended position, but cargo resting on floor 49′ of bed 39. In this manner, movement of expansion portion 12′ from the retracted position to the extended position not only reconfigures the size of the cargo area of bed 39 and the interior space of cab 19, but also provides a mechanism for assisting unloading of cargo from bed 39. It should be understood that cargo positioned near the forward portion of bed 39 may be moved toward the rearward portion of bed 39 by extending expansion portion 12′ from the retracted position to the extended position. By again moving expansion portion 12′ to the retracted position, inserting a spacer (not shown) between rear wall 81′ and the previously moved cargo in bed 39, then again moving expansion portion 12′ to the extended position, a user may further push the cargo toward the rearward portion of bed 39.

[0112] FIGS. 39 and 40 show another embodiment of an apparatus for configuring the cargo area of a vehicle. In this embodiment, a container 89′ is sized to fit within bed 39′ of vehicle 10. Container 89′ generally includes a housing 91′ and an expandable insert 93′. Housing 91′ includes side walls 95′, 97′, upper wall 99′, and lower wall 101′. Housing 91′ may further include a back wall (not shown) adjacent back end 28′ of cab 19 when container 89′ is installed in bed 39′. As best shown in FIG. 40, expandable insert 93′ also includes a pair of side walls 103′, 105′, an upper wall 107′, a lower wall 109′, and a rear wall 111′. The outer dimensions of expandable insert 93′ are configured such that it is moveable within the interior space of housing 91′. Rear wall 111′ may include a window
such as a hatch style window, and a drop down door (not shown) for accessing the interior space defined by expandable insert 93 and housing 91.

[0113] Container 89 may be mounted in bed 39 using convention fasteners or any other type of attachment technology. If housing 91 includes a back wall (not shown), such a back wall may include a window to permit viewing from the interior space of cab 19 through a convention rear window of cab 19, the window of the back wall, and window 115 of rear wall 111. When in the retracted position shown in FIG. 39, container 89 defines a substantially enclosed cargo area in bed 39 of vehicle 10. The volume of the interior space of this cargo area may be increased by moving expandable insert 93 to the extended position shown in FIG. 40. Any of a variety of actuation and support mechanisms may be employed to move expandable insert 93 between the extended position and the retracted position.

[0114] FIGS. 41 through 57 depict a plurality of embodiments of vertically expandable cargo areas according to the present invention. FIGS. 41 and 42 depict an adjustable cover 117 including a plurality of support and actuation assemblies 118, an upper wall 121 that spans between side walls 45, 47 of bed 39 substantially the entire length of bed 39, and a plurality of side panels 123. Assemblies 118 each include a housing 125 shown attached to one of side walls 45, 47. It should be understood, however, that housings 125 may alternatively be mounted within the width of side walls 45, 47. Assemblies 118 further include a first telescoping segment 127 sized to fit within housing 125, and a second telescoping segment 129 sized to fit within first segment 127. One end 133 of second segment 129 is attached to a lower surface of upper wall 121. FIGS. 41, 42. When in the retracted position shown in FIG. 41, adjustable cover 117 essentially functions as a conventional tonneau cover. In the retracted position, adjustable cover 117 therefore defines (along with the other components of bed 39), a first cargo area having a first interior space. When adjustable cover 117 is moved to the extended position shown in FIG. 42, first telescopic segment 127 extends from housing 125 and second telescopic segment 129 extends from first telescopic segment 127 for each of support and actuation assemblies 118. As such, wall 121 is raised above upper edges 51 of side walls 45, 47. As upper wall 121 is moved upward, each side panel 123 engages an adjacent side panel 123, thereby forming substantially continuous side walls that extend upwardly from bed side walls 45, 47.

[0116] Support and actuation assemblies 118 may be driven pneumatically, hydraulically, or electrically to raise and lower upper wall 121 between the extended position and the retracted position. Additionally, any of a plurality of different synchronization techniques may be used to ensure that assemblies 118 maintain upper wall 121 in a substantially horizontal orientation as it is moved between the extended position and the retracted position.

[0117] FIGS. 43 and 44 show another embodiment of adjustable cover 117 wherein support and actuation assemblies 118 have been eliminated. In this embodiment, adjustable cover 117 is moved manually between the extended position and the retracted position. Accordingly, side panels 123 may include locking mechanisms to retain each side panel in engagement with an adjacent side panel 123 to maintain adjustable cover 117 in the extended position shown in FIG. 44.

[0118] FIGS. 45 and 46 show yet another embodiment of an adjustable cover 117 according to the present invention. This embodiment is substantially similar to that shown in FIGS. 41 and 42 except for the arrangement of side panels 123 and the position of support and actuation assemblies 118. More particularly, whereas in the embodiment of FIGS. 41 and 42 the lower most side panels 123 connected to side walls 45, 47 are positioned inwardly relative to the upper most side panels 123 connected to upper wall 121, with the remaining side panels 123 positioned sequentially therebetween, in the embodiment of FIGS. 45 and 46, the upper most side panels 123 are positioned inwardly relative to the lower most side panels 123, with the remaining side panels positioned sequentially therebetween. As a result, whereas the side panels 123 of FIGS. 41 and 42 may be positioned within an interior cavity (not shown) of bed side walls 45, 47 when adjustable cover 117 is in the retracted position, side walls 123 of the embodiment of FIGS. 45 and 46 are depicted as being positioned within the cargo area of bed 39 when adjustable cover 117 is in the retracted position.

[0119] To accommodate the collective widths of side panels 123, support and actuation assemblies 118 may be connected to floor 49 of bed 39 in spaced apart relationship from the interior surfaces of side walls 45, 47. Additionally, upper wall 121 is shown as having overhanging portions 132 to accommodate the collective widths of panels 123 and rest on upper edges 51. Of course, it should be understood that a cavity may also be provided within side walls 45, 47 for receiving side panels 123 of the arrangement shown in FIGS. 45 and 46. In such an embodiment, housings 125 of assemblies 118 may be mounted to side walls 45, 47 and over hanging portions 132 may be eliminated.

[0120] Referring now to FIGS. 47 and 48, another embodiment of an adjustable cover 117 is shown. In this embodiment, support and actuation assemblies 118 each include a lower bracket 135, an upper bracket 136, and a pair of braces 139, 141 that are positioned to cross one another and moveably connected to one another by a pivot pin 142. Lower brackets 135 are mounted to side walls 45, 47 in substantially parallel relationship to upper edge 51 of side walls 45, 47. Each lower bracket 135 includes a rearward slot 145 and a forward slot 147 (not shown). A pin (not shown) attached to the lower end of brace 141 rides within rearward slot 145, and a pin (not shown) attached to the lower end of brace 139 rides within forward slot 147. Upper brackets 136 are mounted adjacent the lower surface of upper wall 121, and similarly include rearward slots 145 and forward slots 147 (not shown) for receiving pins located at respective ends of braces 139, 141.

[0121] As should be apparent from the figures, when adjustable cover 117 is in the retracted position of FIG. 47, upper wall 121 functions as a conventional tonneau cover. Additionally, upper bracket 136 is positioned substantially adjacent to lower bracket 135. Additionally, the pins at the ends of braces 139, 141 are positioned adjacent the forward most ends of forward slots 147 and the rearward most ends of rearward slots 145. As adjustable cover 117 is moved to the extended position of FIG. 48, the upper ends and lower ends of braces 139, 141 are moved toward one another and the corresponding pins move within the corresponding slots to the positions shown in FIG. 48. Braces 139, 141 may be
moved through this scissor-like motion by drawing the lower ends or the upper ends (or both the lower ends and the upper ends) of braces 139, 141 toward one another using a cable and pulley system, electric motors, or any other suitable actuation technique. It should also be understood that a locking mechanism may be incorporated into adjustable cover 117 to maintain braces 139, 141 in the position shown in FIG. 48. Of course, a release mechanism may also be included to either manually or automatically permit movement of braces 139, 141 from the position shown in FIG. 48 to the position shown in FIG. 47. FIG. 48 also illustrates the fact that any number of side panels 123 may be provided to form the side walls of adjustable cover 117 when in the extended position.

[0122] FIGS. 49 and 50 show yet another embodiment of an adjustable cover 117 according to the present invention. In this embodiment, support and actuation assemblies 118 are mounted such that they are retracted substantially entirely within interior cavities (not shown) of bed side walls 45, 47. More specifically, housings 125 of assemblies 118 are mounted within side walls 45, 47 such that segments 127, 129 extend upwardly from within side walls 45, 47 to drive upper wall 121 from the retracted position of FIG. 49 to the extended position of FIG. 50. Suitable connection structure may be provided such that first and second segments 127, 129 of each assembly 118 are substantially continuously connected to the adjacent ends of panels 123 to form corner edges of the space enclosed by adjustable cover 117 when in the extended position.

[0123] FIGS. 51 and 52 show another embodiment of an adjustable cover 117 according to the present invention. In this embodiment, adjustable cover 117 includes a pair of side segments 148, 151 and a pair of top segments 153, 155. Side segment 148 includes a first edge 157 that is pivotally connected adjacent upper edge 51 of side wall 47, and side segment 151 includes a first edge 158 that is pivotally connected adjacent upper edge 51 of side wall 45. A second edge 161 of side segment 148 is pivotally connected to a first edge 163 of top segment 153. Similarly, a second edge 165 of side segment 151 is pivotally connected to a first edge 166 of top segment 155. Top segment 153 further includes a free edge 168 formed to underlap, overlap, or otherwise mate with a free edge 170 of top segment 155 when adjustable cover 117 is in the extended position shown in FIG. 52.

[0124] When adjustable cover 117 is in the retractable position of FIG. 51, top segment 153 is folded against side segment 148 such that when side segment 148 is pivoted downwardly into a substantially parallel orientation relative to side wall 47, top segment 153 is positioned between an inner surface of side wall 47 and an inner surface of side segment 148. Similarly, top segment 155 is positioned between side segment 151 and bed side wall 45. Latches or other locking mechanisms may be provided to retain the segments in this retracted position. A user may manually reconfigure the cargo area of bed 39 by pivoting side segments 148, 151 upwardly to the position shown in FIG. 52, then pivoting top segments 153, 155 upwardly such that free edges 168, 170 engage one another. Additionally, latches or other locking mechanisms may be provided to retain the segments in the extended position shown in FIG. 52. It should be noted that side segments 148, 151 tilt slightly inwardly toward one another when adjustable cover 117 is in the extended position. It should further be noted that additional flaps (not shown) may be provided such that they fold downwardly and/or inwardly from side segments 148, 151 and/or top segments 153, 155 to substantially enclose the rear opening formed by adjustable cover 117 above the tailgate (not shown) when adjustable cover 117 is in the extended position.

[0125] FIGS. 53-55 show yet another embodiment of an adjustable cover 117 according to the present invention. As best shown in FIG. 54, adjustable cover 117 generally includes an upper wall 121, a pair of foldable side walls 172, 174, and a pair of removable inserts 176, 178. Upper wall 121 includes a top panel 204, a forward vertical segment 180 (not shown), a rearward vertical segment 182, four side vertical segments 184, 186, 188, 190, and six side angled segments 192, 194, 196, 198, 200, 202. Segments 180-202 and top panel 204 of upper wall 121 together define an interior space of upper wall 121 for receiving side walls 172, 174 is further described below.

[0126] Since side walls 172, 174 are substantially identical to one another, only side wall 174 will be described in detail herein. Side wall 172 includes a lower segment 206 have a lower edge 208 and an upper edge 210, and an upper segment 212 have a lower edge 214 and an upper edge 216. Upper edge 216 of upper segment 212 defines a notch 218 that is sized to clear wheel well 272 when adjustable cover 117 is in the retracted position as shown in FIG. 53. Lower segment 206 similarly includes a notch 221 sized to clear wheel well 272 when adjustable cover 117 is in the retracted position of FIG. 53. Additionally, side angled segments 192-202 of upper wall 121 define a pair of notches 220 that are sized to clear wheel wells 272 when adjustable cover 117 is in the retracted position. Lower edge 208 of lower segment 206 is pivotally attached to floor 49 of bed 39 adjacent side wall 47. Upper edge 210 of lower segment 206 is pivotally connected to lower edge 214 of upper segment 212. As should be apparent from the drawings, when adjustable cover 117 is in the retracted position of FIG. 53, side walls 172, 174 are folded to lie substantially flat on floor 49 of bed 39 within the interior space defined by top panel 204 and segments 180-202 of upper wall 121.

[0127] As shown in FIG. 54, each of removable inserts 176, 178 includes a top panel 222 and a plurality of side panels 224, which are configured to fit within a respective notch 218, 220 as best shown in FIG. 55. Each removable insert 176, 178 also includes a window panel 226 having a frame 228 and a window section 230. Frame 228 is pivotally connected to a side wall 225 of each insert 176, 178. As should be apparent from the figures, inserts 176, 178 are sized to be positioned over wheel wells 272 when adjustable cover 117 is in the retracted position shown in FIG. 53. In this position, inserts 176, 178 (more specifically, portions of top panels 222 and side panels 224) extend partially through their respective notches 220 of upper wall 121. As adjustable cover 117 is moved toward the extended position, inserts 176, 178 may be removed to permit extension of side walls 172, 174 to the fully extended position of FIG. 55. Inserts 176, 178 may then be inserted in their respective notches 220 such that top panels 222 and side panels 224 of inserts 176, 178 substantially seal notches 220. Window panels 226 of inserts 176, 178 may then be pivoted downwardly and mated with notches 218 of upper segments 212 to form windows in adjustable cover 117 as shown in FIG. 55.

[0128] FIGS. 56 and 57 show an alternate embodiment of an adjustable cover 117 according to the present invention. In this embodiment, a conventional pickup truck cap 229 is connected to upper edges 51 of side walls 45, 47. As best shown in FIG. 57, side walls 45, 47 each include an outer
panel 231 and an inner panel 232. When adjustable cover 117 is in the retracted position of FIG. 56, inner panels 232 fit within a cavity (not shown) formed in outer panels 231. Alternatively, guides or tracks may be formed in either of panels 231, 232 to enable outer panels 231 to move vertically, relative to inner panels 232. When adjustable cover 117 is moved to the extended position of FIG. 57, outer panels 231 of side walls 45, 47, and cap 229 are raised vertically relative to floor 49 of bed 39 to increase the vertical dimension of the cargo area of bed 39. It should be understood that any of a variety of support and actuation assemblies 118 may be used to move adjustable cover 117 between the extended position and the retracted position, and to support adjustable cover 117 when in the extended position of FIG. 57.

[0129] Referring now to FIGS. 58 and 59, another embodiment of an apparatus for configuring the cargo area of a vehicle is shown. In this embodiment, side walls 45, 47 of bed 39 extend laterally relative to longitudinal axis X of vehicle 10 to increase a horizontal dimension of the cargo area of bed 39. In the depicted embodiment, each of side walls 45, 47 includes a forward wall 234 that is movable within an opening in an end wall 236 of bed 39. Each side wall 45, 47 further includes a floor portion 238 that extends inwardly from the side wall. Each floor portion 238 includes floor panels 240, 242 and wheel well panels 244, 246, 248. When side walls 45, 47 are in the retracted position of FIG. 58, forward walls 234 are positioned within end wall 236, floor panels 240, 242 are positioned over floor 49, and wheel well panels 244, 246, 248 are positioned over wheel wells 272. When side walls 45, 47 are moved to the extended position of FIG. 59, each of the above-described components moves outwardly relative to longitudinal axis X of vehicle 10 to increase the area of floor 49 of bed 39. Again, it should be understood that a plurality of different support and actuation assemblies 118 may be adapted to facilitate movement of side walls 45, 47 between the extended position and the retracted position. It should further be understood that forward walls 234 may be positioned adjacent end wall 236 (as opposed to within end wall 236) when side walls 45, 47 are in the retracted position. Similarly, floor panels 240, 242 and wheel well panels 244, 246, 248 may be positioned within recesses or openings formed in or below floor 49 and wheel wells 272 (as opposed to over those components) when side walls 45, 47 are in the retracted position.

[0130] FIGS. 60 and 61 depict yet another embodiment of an apparatus for adjusting the cargo area of a vehicle. In this embodiment, side walls 45, 47 are pivotally mounted to floor 49 of bed 39. More specifically, each side wall 45, 47 includes a lower hinge (not shown) adjacent the intersection between the side wall and floor 49. Additionally, each side wall 45, 47 may include a locking mechanism (not shown) along a front edge 250 of the side wall for mating with a corresponding latch or locking mechanism (not shown) positioned along an edge 252 of end wall 236, thereby locking the side wall in a vertical orientation as shown in FIG. 60. When side walls 45, 47 are moved to the extended position shown in FIG. 61, the locking mechanisms are disengaged to permit side walls 45, 47 to pivot outwardly into a substantially planar orientation relative to floor 49 of bed 39. As can be seen in FIG. 61, each of side walls 45, 47 includes a notch 254 to accommodate wheel well 272 of bed 39 when the side wall is in the retracted position. After moving side walls 45, 47 to the extended position, the user has substantially unimpeded access to cargo stored in bed 39. For example, a forklift may be used to access pallets loaded on floor 49 not only from the tailgate end of floor 49, but also from the sides of floor 49.

[0131] FIGS. 62-64 depict still another embodiment of an apparatus for configuring the cargo area of a vehicle. In this embodiment, bed 39 includes a movable floor portion 256, which is positioned over floor 49 of bed 39 when in the retracted position. Floor portion 256 includes a pair of notches 258, 260 configured to clear enclosures 262, 264 formed over wheel wells 272. Each of enclosures 262, 264 includes a removable top panel 266 which is configured to mate with a respective notch 258, 260 of floor portion 256 as is further described below.

[0132] When in the retracted position of FIG. 62, floor portion 256 is positioned on floor 49 of bed 39 and top panels 266 are secured to an upper end of enclosures 262, 264. In this position, substantially the entire vertical dimension of cargo area of bed 39 is available for cargo. FIG. 63 depicts floor portion 256 in an intermediate position between the retracted position and the extended position. In this intermediate position, notches 258, 260 engage and couple to top panels 266. As floor portion 256 is moved to the fully extended position of FIG. 64, floor portion 256 and top panels 266 form a substantially continuous cover (similar to a conventional tonneau cover) for the cargo area of bed 39.

[0133] As should be understood from the foregoing, any of a variety of different support and actuation assemblies 118 may be used to move floor portion 256 between the retracted position and the extended position. In this manner, floor portion 256 may, in addition to functioning as a cover over the cargo area of bed 39 when in the extended position, function as a lift to raise cargo stored in bed 39 to permit unloading of the cargo over side wall 45, 47. More specifically, when floor portion 256 is in the extended position of FIG. 64, a forklift has substantially unimpeded access from the side of vehicle 10 to, for example, pallets loaded on floor portion 256. As should also be apparent from the drawings, movable floor portion 256 permits loading of the cargo area of bed 39 by placing cargo on floor portion 256 while floor portion 256 is in the extended position. In this manner, individuals loading bed 36 can avoid sliding cargo rearward from the tailgate end of bed 39 toward the forward end of bed 39 or reversing cargo into bed 39 over side walls 45, 47. Once the cargo is loaded onto floor portion 256, the user may retract floor portion 256 to the retracted position of FIG. 62. As floor portion 256 moves toward the retracted position, it moves through the intermediate position of FIG. 63 and disengages from top panels 266 as top panels 266 engage enclosures 262, 264 over wheel wells 272. This automatic decoupling may be accompanied by automatic latching of top panels 266 to their respective enclosures 262, 264.

[0134] FIGS. 65 and 66 show a variation of the apparatus depicted in FIGS. 62-64. In this variation, floor portion 256 is substantially identical to floor portion 256 of the preceding figures. Side walls 45, 47, however, each include a movable upper panel 268 that may extend substantially the entire length of the respective side wall 45, 47. Panels 268 are pivotally connected to their respective side walls 45, 47 such that they are movable outwardly to the substantially horizontal orientation shown in FIG. 66. Like the embodiment shown in FIGS. 60 and 61, upper panels 268 may include latching or locking mechanisms that cooperate with corresponding mechanisms mounted to end wall 236 of bed 39 to secure upper panels 268 in the vertical orientation shown in FIG. 65.
As should be apparent from the foregoing, floor portion 256 may be moved between the retracted position and the fully extended position in the same manner as described above with reference to FIGS. 62-64 when upper panels 268 are in the vertical orientation. Additionally, floor portion 256 may be positioned in the intermediate position shown in FIG. 66, and upper panels 268 may be pivoted outwardly to their horizontal orientation, thereby forming a substantially planar raised surface over floor 49 of bed 39. The embodiment of FIGS. 65 and 66 provides the same lifting and lowering capability of the previously described embodiment as well as permitting side loading and unloading of cargo onto floor portion 256 when in the fully extended position or the intermediate position depicted in FIG. 66.

The foregoing description of the invention is illustrative only, and is not intended to limit the scope of the invention to the precise terms set forth. Although the invention has been described in detail with reference to certain illustrative embodiments, variations and modifications exist within the scope and spirit of the invention as described and defined in the following claims.

What is claimed is:

1. A vehicle, including:
   a body having a cab and a bed;
   a first expansion portion connected to a back end of the cab for movement toward the back end into a retracted position and away from the back end into an extended position, thereby respectively decreasing and increasing an interior space of the cab; and
   a second expansion portion connected to the bed for movement toward the back end into a retracted position and away from the back end into an extended position, thereby respectively decreasing and increasing a cargo area of the bed, wherein the vehicle has a first wheel base length when the first expansion portion is in the retracted position and a second wheel base length, which is larger than the first wheel base, when the first expansion portion is in the extended position.

2. The vehicle of claim 1, wherein the vehicle has a first length when the second expansion portion is in the retracted position and a second length, which is larger than the first length, when the second expansion portion is in the extended position.

3. A vehicle including:
   a body having a cab, a bed, a longitudinal axis, and a longitudinal length; and
   an expansion portion movable between an extended position and a retracted position, wherein the wheel base of the vehicle increases during movement of the expansion portion from the retracted position to the extended position.

4. The vehicle of claim 3, wherein movement of the expansion portion from the retracted position to the extended position increases the passenger space of the vehicle.

5. The vehicle of claim 4, wherein movement of the expansion portion from the retracted position to the extended position increases the viewing area of the vehicle.

6. The vehicle of claim 4, wherein the cab includes a window, the expansion portion includes a window that aligns with the window of the cab when the expansion portion is in the retracted position and is not aligned with the expansion portion when the expansion portion is in the extended position to increase the window area of the vehicle.

7. A vehicle including:
   a body having a cab and a bed having a front end and a back end; and
   a bed expansion portion connected to the bed for movement toward the back end into a retracted position and away from the back end into an extended position, thereby respectively decreasing and increasing a cargo area of the bed, wherein the wheel base of the vehicle is adjustable between a first length and a second length that is greater than the first length.

8. The vehicle of claim 7, wherein the bed includes first and second side walls and the bed expansion portion includes first and second side walls substantially positioned between the first and second side walls of the bed when the bed expansion portion is in the retracted position.

9. The vehicle of claim 7, wherein the bed expansion portion moves along a longitudinal path between the retracted and expanded positions.

10. The vehicle of claim 7, wherein the bed expansion portion includes a tail gate.

11. The vehicle of claim 7, wherein the bed expansion portion includes a bumper.

12. The vehicle of claim 11, wherein the bumper is positioned closer to the cab when in the retracted position than when positioned in the extended position.

13. The vehicle of claim 7, wherein the bed includes an upper edge and the bed expansion portion includes an upper edge that is substantially continuous with the upper edge of the bed.

14. The vehicle of claim 7, further comprising a cab expansion portion movable between a retracted position providing a first volume of passenger space and an extended position providing a second volume of passenger space that is greater than the first volume of passenger space.

15. A vehicle including:
   a body having a cab and a bed, the cab having a back end and a front end; and
   a cab expansion portion connected to a back end of the cab for movement toward the back end into a retracted position and away from the back end into an extended position, thereby respectively decreasing and increasing an interior space of the cab, wherein the vehicle length increases during movement of the cab expansion portion from the retracted position to the extended position.

16. The vehicle of claim 15, wherein the wheel base of the vehicle increases during movement of the cab expansion portion from the retracted position to the extended position.

17. The vehicle of claim 15, wherein the cab expansion portion is substantially positioned in the cab when in the retracted position and substantially positioned outside of the cab when in the extended position.

18. The vehicle of claim 17, wherein the cab expansion portion includes at least one member telescopically received in the cab.

19. The vehicle of claim 18, wherein the cab expansion portion includes a window that is exposed when the cab expansion portion is in the extended position.

20. The vehicle of claim 15, wherein the cab expansion portion includes a seal positioned adjacent to the cab.

21. A vehicle, including:
   a body having a passenger space, a storage space positioned rearward of the passenger space, a longitudinal axis, front wheels, rear wheels, a wheel base defined between the front wheels and the rear wheels, and a longitudinal length; and
an expansion portion movable between an extended position and a retracted position, wherein the wheel base of the vehicle increases during movement of the expansion portion from the retracted position to the extended position.

22. The vehicle of claim 21, wherein the storage space is defined by a bed including a bottom and a plurality of substantially vertical walls.

23. The vehicle of claim 21, wherein the expansion portion cooperates with the body to define the passenger space which increases as the expansion portion moves to the extended position.

24. The vehicle of claim 21, wherein the volume of the storage space changes between a first volume and a second volume that is substantially greater than the first volume.

25. The vehicle of claim 24, wherein the change of volume of the storage space is independent of movement of the expansion portion.

26. The vehicle of claim 21, wherein the longitudinal length of the storage space changes between a first length and a second length that is substantially greater than the first length.

27. The vehicle of claim 26, wherein the change of the longitudinal length of the storage space length is independent of movement of the expansion portion.

28. A vehicle including:
   a body having a cab and storage receptacle defining a storage space, the storage receptacle having a front end and a back end; and
   a storage space expansion portion connected to the receptacle for movement toward the back end into a retracted position and away from the back end into an extended position thereby respectively decreasing and increasing a storage space, wherein the wheel base of the vehicle is adjustable between a first length and a second length that is greater than the first length.

29. The vehicle of claim 28, wherein the storage receptacle includes a bottom and a plurality of substantially vertical walls defining a bed.

30. The vehicle of claim 28, wherein the length of the storage space changes between a first length and a second length that is substantially greater than the first length.

31. The vehicle of claim 28, wherein a volume of the cab is adjustable between a first volume and a second volume that is substantially greater than the first volume.

32. The vehicle of claim 28, wherein the adjustment of the wheelbase is independent of the movement of the storage space expansion portion.