A compactable luggage system includes a portable container having an internal storage compartment structured and arranged to store at least one travel item, an one outer-volume reducer structured and arranged to reduce an outer volume of the portable container. The portable container includes a pressure-tight barrier structured and arranged to bar equalization of fluid pressures across the pressure-tight barrier surrounding the internal storage compartment, and a re-sealable access structured and arranged to provide re-sealable access to the one internal storage compartment through said pressure-tight barrier. The portable container includes a pressure-dependent volume adjuster structured and arranged to adjust the outer volume of the one portable container in response to the fluid pressure differential across the pressure-tight barrier. This and other features are described.
COMPACTABLE LUGGAGE SYSTEM

CLAIM OF PRIORITY


BACKGROUND

[0002] Packing for airline travel now requires considerable advance planning and consideration. Many items previously allowed within carry-on luggage are now restricted or banned from U.S. flights by the Transportation Security Administration (TSA). Furthermore, many airlines are now charging for checked baggage. Most airlines have policies restricting the size of carry-on luggage. Many luggage manufacturers produce luggage marketed as “carry-on,” but many of these bags can be packed to a size larger than most airlines will accept. Unlucky travelers frequently find themselves attempting to squeeze such a carry-on bag into the luggage size template provided at the boarding gate (often having to check the bag after finding the bag to be a few inches larger than the maximum allowed). Considering the above-noted issues, a need exists for improved luggage systems facilitating air travel in the current era of increased security and size restrictions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. 1 depicts a perspective view of a luggage system in accordance with an embodiment of the present invention;

[0004] FIG. 2 depicts a side view of the embodiment of FIG. 1;

[0005] FIG. 3 depicts the a side view of FIG. 2 after vacuum-assisted compaction in accordance with an embodiment of the invention;

[0006] FIG. 4 depicts a sectional view through the section 4-4 of FIG. 2;

[0007] FIG. 5 depicts a schematic diagram of an electrically-powered pump assembly in accordance with an embodiment of the invention;

[0008] FIG. 6 depicts a schematic diagram illustrating a manually-actuated pump assembly in accordance with an embodiment of the invention;

[0009] FIG. 7 depicts a perspective view of a luggage system in accordance with an embodiment of the invention;

[0010] FIG. 8 depicts an exploded perspective view of the embodiment of FIG. 7; and

[0011] FIG. 9 depicts an exploded perspective view of a luggage system in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

[0012] An embodiment in accordance with the invention provides an improved carry-on travel luggage system. More particularly, an embodiment provides a compactable carry-on travel luggage system configured to assist a traveler to utilize the currently-restricted carry-on baggage option for airline travel. An embodiment in accordance with the invention provides a system that utilizes vacuum-assisted compaction of a travel bag. In one implementation such a system can utilize an onboard (integrated) vacuum generator to assist compaction of the travel bag. In another implementation the vacuum generator may be apart, separate, or free standing from the vacuum-assisted compaction travel bag. The vacuum generator may be either a manually-operated or electrically-operated vacuum generator.

[0013] In accordance with an embodiment of the invention, the compactable luggage system can utilize a wheeled chassis vacuum-assisted user transport. An embodiment of the invention may provide transparent storage compartments to facilitate efficient security inspection of contents of carry-on travel luggage.

[0014] In accordance with an embodiment of the invention, a compactable luggage system can assist compact transport of at least one travel item during travel. An embodiment of the compactable luggage system may include at least one portable container having at least one internal storage compartment structured and arranged to portably store the at least one travel item during the travel, and at least one outer-volume reducer structured and arranged to reduce an outer volume of such at least one portable container during the travel. The at least one portable container can include surrounding such at least one internal storage compartment, at least one pressure-tight barrier structured and arranged to bar equalization of fluid pressures across such at least one pressure-tight barrier, and at least one re-sealable access structured and arranged to provide re-sealable access to such at least one internal storage compartment through such pressure-tight barrier, wherein such at least one portable container may include at least one pressure-dependent volume adjuster structured and arranged to adjust the outer volume of such at least one portable container in response to at least one fluid pressure differential across such at least one pressure-tight barrier. The at least one outer-volume reducer can include at least one vacuum generator structured and arranged to generate the at least one fluid pressure differential by generating at least one sub-ambient fluid pressure within such at least one internal storage compartment, and at least one integrator to integrate such at least one vacuum generator within such at least one portable container, and wherein generation of the at least one sub-ambient fluid pressure within such at least one internal storage compartment results in a volumetric contraction of such at least one pressure-tight barrier and corresponding reduction in the outer volume of such at least one portable container.

[0015] An embodiment of a compactable luggage system in accordance with the invention can also include at least one wheeled chassis structured and arranged to assist wheeled transport of such at least one portable container. Additionally, it provides such a compactable luggage system wherein such at least one vacuum generator comprises at least one manually-operated vacuum pump. Also, it provides such a compactable luggage system wherein such at least one manually-operated vacuum pump comprises at least one foot-operated vacuum pump; and such at least one foot-operated vacuum pump is retractably deployable from such at least one portable container. In addition, it provides such a compactable luggage system wherein such at least one vacuum generator comprises at least one electrically-operated vacuum pump. And, it provides such a compactable luggage system further comprising: at least one electric power circuit structured and arranged to conduct electric power to such at least one electrically-operated vacuum pump; wherein such at least one electric power circuit comprises at least one control circuit structured and
An embodiment in accordance with the invention may provide such a compactable luggage system wherein such at least one control circuit comprises at least one user control structured and arranged to enable user control of such at least one electrically-operated vacuum pump. Additionally, it provides such a compactable luggage system wherein such at least one control circuit further has at least one automatic control structured and arranged to automatically control the operation of such at least one electrically-operated vacuum pump. Also, it provides such a compactable luggage system wherein such at least one automatic control can include at least one vacuum-pump cutoff configured to terminate the operation of such at least one electrically-operated vacuum pump when the at least one sub-ambient fluid pressure, within such at least one internal storage compartment, drops to at least one first selected level.

An embodiment in accordance with the invention may provide a compactable luggage system where at least one automatic control further includes at least one vacuum-pump initiator structured and arranged to initiate the operation of such at least one electrically-operated vacuum pump when the at least one sub-ambient fluid pressure, within the at least one internal storage compartment, rises to at least one second selected level. And, it provides such a compactable luggage system where the at least one vacuum-pump cutoff can include at least one electrical-current-draw detector structured and arranged to detect electrical-current draw of such at least one electrically-operated vacuum pump, and operation of such at least one electrically-operated vacuum pump is terminated by such at least one vacuum-pump cutoff when an electrical-current draw above a selected threshold is detected.

An embodiment in accordance with the invention may provide a compactable luggage system where at least one vacuum-pump cutoff has at least one timer structured and arranged to operate at least one selected duration of vacuum pump operation, and such at least one vacuum-pump cutoff is structured and arranged to terminate the operation of such at least one electrically-operated vacuum pump upon elapsing of the at least one selected duration of vacuum pump operation. Even further, it provides such a compactable luggage system further including at least one pressure detector to detect the presence of the at least one first selected level and the at least one second selected level within such at least one internal storage compartment.

An embodiment in accordance with the invention may provide a compactable luggage system having at least one fluid-pressure conduit structured and arranged to form at least one fluid-pressure connection between at least one internal storage compartment and at least one vacuum generator, and disposed within such at least one fluid-pressure conduit, at least one back-check valve structured and arranged to check backward pressure equalization through such at least one vacuum generator when such at least one vacuum generator is not in operation.

An embodiment in accordance with the invention may provide a compactable luggage system where at least one portable container may have at least one viewable storage compartment and arranged to viewably store at least one travel item requiring periodic visual inspection, where at least one viewable storage has at least one viewable compartment structured and arranged to compartment therein the at least one travel item requiring periodic visual inspection at least one closable access to provide closable access to such at least one viewable compartment, and at least one transparent portion adapted to provide a view within such at least one viewable compartment from outside such at least one viewable storage, even when such at least one closable access is in a closed position. Even further, it provides such a compactable luggage system wherein: such at least one viewable compartment is located within such at least one pressure-tight barrier; and such at least one closable access comprises at least one pressure-tight seal when closed.

An embodiment in accordance with the invention may provide a compactable luggage system to assist compact transport of at least one travel item during travel, such compactable luggage system may include at least one airtight-closable enclosure to enclose the at least one travel item. In fluid communication with such at least one airtight-closable enclosure, at least one vacuum source to generate at least one partial vacuum within such at least one airtight-closable enclosure, and at least one wheeled chassis structured and arranged to assist wheeled transport of both such at least one airtight-closable enclosure and such at least one vacuum source. Creation of the at least one partial vacuum within such at least one airtight-closable enclosure collapses such at least one airtight-closable enclosure around the at least one travel item, and when collapsed, such at least one airtight-closable enclosure comprises at least one reduced external volume.

An embodiment in accordance with the invention may provide a compactable luggage system to assist compact transport of at least one travel item during travel, such compactable luggage system may have at least one airtight-closable enclosure to enclose the at least one travel item, and in fluid communication with such at least one airtight-closable enclosure, at least one manually-operated vacuum source structured and arranged to generate at least one partial vacuum within such at least one airtight-closable enclosure. Creation of the at least one partial vacuum within such at least one airtight-closable enclosure collapses such at least one airtight-closable enclosure around the at least one travel item; and when collapsed, such at least one airtight-closable enclosure comprises at least one reduced external volume. Even further, it provides such a compactable luggage system wherein such at least one manually-operated vacuum pump comprises at least one foot-operated vacuum pump.

FIG. 1 depicts a perspective view illustrating compactable travel bag 102 according to an embodiment of the
Compactable travel bag 102 may include a vacuum-compactable article of luggage (at least embodying herein at least one portable container) designed to assist compact transport of one or more travel items 101 during travel. Embodiments of luggage system 100, which includes compactable travel bag 102, may include one or more sealable internal storage compartment(s) 104 configured to store travel items 101 during travel, as shown. In addition, each compactable travel bag 102 can include at least one vacuum-assisted compartment 103 designed to “compact” portions of the bag by temporarily reducing the outer volume (physical size) of portions of the device. Vacuum-assisted compartment 103 (at least embodying herein at least one outer-volume reducer) preferably operates by evacuating air from internal storage compartment(s) 104 to, in effect, “deflate” the compactable travel bag 102 around travel items 101.

Each internal storage compartment 104 is configured to form a continuous pressure-containing envelope around travel items 101 (such as, clothing, personal items, etc.). More specifically, each internal storage compartment 104 is surrounded by a continuous pressure-tight barrier 105 configured to prevent equalization of fluid pressures across pressure-tight barrier 105 (that is, between internal storage compartment 104 and the surrounding atmosphere).

To allow user access to internal storage compartment 104, pressure-tight barrier 105 is equipped with at least one re-sealable access opening 108, as shown. Each re-sealable access opening 108 includes a mechanism for repeatedly forming a pressure-tight seal 109 along the length of the opening. Sealing arrangements include self-sealing overlapping flaps (as shown), alternately preferably, zip-locking closures (not shown but similar to closures distributed under the ZIPLOC® brand name), folded closures (not shown), seal-forming zippers 111, roll-down closures. Seal-forming zippers 111 can include at least two sets of zipper seals adapted to form a continuous pressure-tight seal on closure. Roll-down-type closures comprise a projecting ring of gas-impermeable material surrounding the access opening (not shown), which can be manipulated to form a pressure seal by rolling together opposing halves of the ring. The distal periphery of the ring may also comprise a secondary seal in the form of the releasable zip-locking closure noted above. In this roll-down-type arrangement, re-sealable access opening 108 is sealed by engaging the releasable interlocking closure, followed by rolling down the end of the above-noted gas-impermeable ring several times to form a double pressure-retaining seal. One or more retainers may be supplied to keep the above-noted ring of gas-impermeable material from unrolling. Under appropriate circumstances, considering such issues as cost, user preference, convenience, etc., other sealing arrangements such as, for example, pressure-sealed doors, sliding or removable pressure-sealed panels, clamping closures, wide-mouth threaded caps, temporary seam tapes, tamper-indicating closures, etc., may suffice.

Compactable travel bag 102 comprises at least one pressure-dependent volume-adjustment feature 110 (at least embodying herein at least one pressure-dependent volume adjuster) enabling changes to the outer volume of compactable travel bag 102 in response to pressure differentials developed across pressure-tight barrier 105. More specifically, at least a portion of compactable travel bag 102 is configured to allow volumetric changes to the outer geometry of the device. Embodiments in accordance with the invention may include system volume-adjustment feature 110. Volume-adjustment feature 110 may have at least one mechanically-collapsible region 112 incorporated within compactable travel bag 102 (and the pressure-tight barrier 105 integrated therein). For example, an embodiments may have a soft-sided construction of durable fabric 136 combined with a flexible gas-impermeable membrane 138 (or coating) forming pressure-tight barrier 105 (see FIG. 4 showing the sectional view through the section 4-4 of FIG. 2). Materials suitable for use as the outer shell fabric 136 include ballastic nylons, “air treated” nylon fabrics, polyester pack cloths, natural fiber fabrics, blended fiber compositions, flexible gas-impermeable polymeric sheets, etc. Materials suitable for use as gas-impermeable membrane 138 include flexible gas-impermeable polymeric sheets, silicone-impregnated fabrics, vinyl coatings, thermoplastic polyurethane (TPU) coatings, laminated constructions, etc.

In accordance with the invention, alternate embodiments of the system can have hard-sided outer shells (not shown) constructed from one or more rigid plastics. Such hard-sided outer shells can be divided into one or more slidably inter-articulating sections, thereby allowing the outer shell to contract and expand as required. Under appropriate circumstances, considering such issues as intended use, user preference, etc., other shell arrangements such as, for example, providing a fixed size outer shell enclosing one or more vacuum-compactable internal storage compartment, etc., may suffice. In such an arrangement, the vacuum-compactable internal storage compartments may be independently evacuated, or simultaneously deflated.

The internal storage compartment(s) 104 of compactable travel bag 102 (at least embodying herein at least one airtight-closable enclosure) can be coupled individually, or by pressure-conducting manifold passages, to vacuum-assisted compactor 103, comprising at least one controllable vacuum-pressure source, including vacuum pump assembly 106 (see also FIG. 5 and FIG. 6). Vacuum pump assembly 106 (at least embodying herein at least one vacuum generator and at least embodying herein at least one vacuum source to generate at least one partial vacuum within such at least one airtight-closable enclosure) is used to evacuate air from at least one of the internal storage compartments 104 within the bag. The result of such evacuation is the generation of a fluid-pressure differential across pressure-tight barrier 105 that effectively “deflates” the internal storage compartment 104. More specifically, vacuum pump assembly 106 is used to generate a sub-ambient pressure within one or more internal storage compartments 104, which may result in a volumetric contraction of pressure-tight barrier 105 and corresponding compaction of compactable travel bag 102, and its contents, from physical size A to the narrower physical size B, as illustrated in FIG. 2 and FIG. 3. FIG. 3 shows a side view, illustrating compactable travel bag 102 after such vacuum-assisted compaction. Under appropriate circumstances, considering such issues as selected bag shape, intended use, etc., other compaction arrangements such as, for example, reducing the dimension of a bag along additional/multiple axes, providing compression straps to help maintain the compacted
configuration after vacuum-assisted compaction, providing vacuum-assisted compaction of interior portions of the bag only, etc., may suffice.

[0032] It is noted that vacuum-assisted compactor 103 at least embodies herein at least one "outer-volume reducer" comprising at least one vacuum generator (vacuum pump assembly 106) structured and arranged to generate at least one fluid pressure differential by generating at least one sub-ambient fluid pressure within such at least one internal storage compartment, and wherein generation of the at least one sub-ambient fluid pressure within such at least one internal storage compartment results in the above-noted volumetric contraction of such at least one pressure-tight barrier and corresponding reduction in the outer volume of such at least one portable container. Furthermore, the above-described arrangements embodiment create at least one partial vacuum within such at least one airtight-closable enclosure so as to collapse the at least one airtight-closable enclosure around the at least one travel item. When collapsed the at least one airtight-closable enclosure comprises at least one reduced external volume.

[0033] A system in accordance with an embodiment of the invention may include an integrated (onboard) vacuum pump assembly 106, as shown. In such an embodiment, vacuum pump assembly 106 can be located in a side pocket 115 of the bag, as shown (at least embodying herein at least one integrator to integrate such at least one vacuum generator within such at least one portable container). Under appropriate circumstances, considering such issues as cost, user convenience, bag geometry, etc., other integration strategies such as, for example, mounting a vacuum generator within a frame structure of the bag, placing a vacuum generator within a compartment detachable from the bag, integrating a vacuum generator within rolling chassis to enable actuation of a pump using power derived from the rolling of the bag, etc., may suffice. Furthermore, under appropriate circumstances, considering such issues as cost, user preference, etc., other vacuum sources such as, for example, external vacuum "stations" (for example, provided at the boarding gate), disposable or reusable pre-evacuated vacuum canisters and/or bottles, pumps carried separately from the bag, venturi-base vacuum devices operated by attachment to a faucet, etc., may suffice.

[0034] A system in accordance with an embodiment of the invention may include at least one viewable storage compartment 130 to allow visual inspection of selected stored travel items 101, without breaking the vacuum seal of the primary internal storage compartments 104 within the compactable travel bag (at least embodying herein at least one viewable storage structured and arranged to viewably store at least one travel item requiring periodic visual inspection). Viewable storage compartment 130 comprises at least one "transparency" portion incorporated with the wall structure of the compartment, and at least one closable access opening 142 to provide re closable access to the interior of the viewable storage compartment 130. "Transparency" portion 144 can be designed to allow viewing of the interior of viewable compartment from outside viewable storage compartment 130, even when closable access opening 142 is in a closed position.

[0035] Transparent portion 144 can include at least one transparent window formed from a panel of clear plastic or, alternately, a section of open netting (if the compartment is not required to be pressure compactable). Within the teachings of this specification, the term "transparent" may also comprise the term "translucent", such that at least one portion of the viewable compartment is sufficiently visible-light-permeable to allow an individual or visual-recognition device to determine if a travel item 101 has been placed within the viewable compartment. Under appropriate circumstances, considering such issues as cost, user preference, etc., other arrangements such as, for example removable (non-pressurized) storage compartments, protective over covers for the transparent panels, alternate positioning of the transparent compartment on the bag, etc., may suffice.

[0036] Referring again to FIG. 1, an embodiment of the system may also comprise a wheeled support chassis 132, as shown, to facilitate rolling transport of the device (at least embodying herein at least one wheeled chassis structured and arranged to assist wheeled transport of such at least one portable container). Wheeled support chassis 132 comprises at least one extendable hand grip 133 to facilitate manual manipulation by the user. Under appropriate circumstances, considering such issues as cost, user preference, etc., other bag transport arrangements such as, for example, slip panels allowing the bag to slide over and be supported by the handle of other wheeled luggage, shoulder straps, haul handles, backpack-style straps/belts, etc., may suffice.

[0037] FIG. 5 shows a schematic diagram illustrating an electrically-powered pump assembly 114, according to an embodiment of the system in accordance with the invention. Electrically-operated embodiments of vacuum pump assembly 106 at least comprise an electrically-operated vacuum pump 118, as shown (at least embodying herein wherein at least one vacuum generator comprises at least one electrically-operated vacuum pump). Electrically-operated vacuum pump 118 is operably coupled to (that is, in fluid-pressure communication with) one or more internal storage compartments 104 of compactable travel bag 102, as shown. Electrically-operated vacuum pump 118 and internal storage compartment(s) 104 are coupled by at least one connective pressure line 120, as shown (at least embodying herein at least one fluid-pressure conduit structured and arranged to form at least one fluid-pressure connection between such at least one internal storage compartment and such at least one vacuum generator). In an embodiment, pressure line 120 comprises check valve 122 to maintain pressure within sealable compartment 104 by checking backward pressure equalization through the pump assembly, after terminating operation of the pump (at least embodying herein at least one back-check valve structured and arranged to check backward pressure equalization through such at least one vacuum generator when such at least one vacuum generator is not in operation).

[0038] As schematically depicted in FIG. 5, the operation of electrically-operated vacuum pump 118 is controlled by electric power circuit 124. Electric power circuit 124 is structured and arranged to conduct electric power to electrically-operated vacuum pump 118. In one embodiment of the invention, electric-pump circuit 124 comprises at least one onboard (integrated) electric-pump supply 148 configured to supply dedicated electric power to electric power circuit. Onboard electric-power supply 148 comprises one or more onboard electrochemical cells (identified herein as onboard batteries 150) used to convert stored chemical energy into electrical energy. Onboard batteries 150 supply low-voltage Direct Current (DC) to a DC drive motor of the pump assembly. Onboard batteries 150 can comprise one or more commercially-available designs utilizing conventional battery chemistries. Onboard batteries 150 are of a primary type or a
secondary (rechargeable) type, such as, for example nickel-cadmium (NiCd), alternately, nickel-zinc (NiZn), alternately, nickel metal hydride (NiMH), alternately, lithium-ion (Li-ion) cells. Under appropriate circumstances, considering such issues as cost, user intended use, etc., other power arrangements such as, for example, solar cells, fuel-cell based technology (e.g., direct methanol fuel cells), new and emerging cell chemistries, manually-actuated electrical generators, etc., may suffice.

[0039] In an embodiment in accordance with the invention, onboard electric-power supply 148 is stored within and supported by the structures of compactable travel bag 102. In one onboard-power embodiment of the invention, onboard electric-power supply 148 is stored in either a side panel or side pocket 115 of compactable travel bag 102, as best shown in FIG. 1.

[0040] In an alternate embodiment of the invention, electric-power circuit 124 utilizes electrical power from a source external of compactable travel bag 102. In this alternate arrangement, electric-power circuit 124 can comprise at least one electrical coupler 152 adapted to releasably couple electric power circuit 124 to the external electrical power source. In an embodiment, electric coupler 152 is configured to couple electric power circuit 124 to a low-voltage AC/DC power adapter adapted to plug into a line-voltage wall outlet. Alternately, electric coupler 152 is configured to permit coupling to a computer data port having at least one electrically-energized pin. One form of such electrical coupler 152 comprises a configuration compatible with the Universal Serial Bus (USB) standards for peripheral devices. These devices customarily provide about 5 volts direct current (DC) at up to about 900 mA load draw (under the USB 3.0 specification). Under appropriate circumstances, considering such issues as cost, user preference, etc., other power arrangements such as, for example, the use of an onboard (integrated) AC/DC transformer having a deployable cord adapted to plug into a line-voltage wall outlet, providing a universal adapter to accommodate international power standards, etc., may suffice.

[0041] In an embodiment in accordance with the invention, electric power circuit 124 can comprise at least one pump controller circuit 146 adapted to control the conditions of delivery of electric power to electrically-operated vacuum pump 118. A basic control incorporated within embodiments of the invention is at least one manually-operated user control 154 to enable manual control of electrically-operated vacuum pump 118. User control 154 may comprise an electric switch adapted to enable or disable the conduction of electrical power between the power source and pump. This basic control allows the user to manually start and stop the vacuum-assisted compaction of compactable travel bag 102.

[0042] In an embodiment in accordance with the invention, pump controller circuit 146 can include at least one automatic control 156 configured to automatically control one or more aspects of the operation of electrically-operated vacuum pump 118. This feature can be incorporated into the system to promote both operational efficiency and user convenience.

[0043] In an embodiment in accordance with the invention, automatic control 156 can comprise an automatic vacuum-pump cutoff 158 configured to terminate the operation of electrically-operated vacuum pump 118 when a selected sub-ambient fluid pressure is achieved within internal storage compartment 104. In operation, the user initiates the operation of electrically-operated vacuum pump 118 using user control 154. Automatic vacuum-pump cutoff 158 is configured to terminate the operation of electrically-operated vacuum pump 118 when the sub-ambient fluid pressure within internal storage compartment 104 drops to a first selected pressure level. Determination of the first selected pressure level is achieved using one or more techniques described below.

[0044] In accordance with an embodiment of the invention, an indirect determination of the first selected pressure level is achieved by detecting the electrical-current draw of electrically-operated vacuum pump 118. In this arrangement, automatic vacuum-pump cutoff 158 comprises at least one electrical-current-draw detector 160 configured to detect the electrical-current draw of electrically-operated vacuum pump during the vacuum-assisted compaction of compactable travel bag 102. As air is evacuated from internal storage compartment 104, electrically-operated vacuum pump 118 exhibits a detectable change in current draw. Electrical-current-draw detector 160 is configured sense the current (amperage) draw of electrically-operated vacuum pump 118 and to compare the measured current against a pre-selected threshold value. If the detector determines that the current draw of the pump has reached the pre-selected value (for more than a specified duration), the electrical-current-draw detector 160 will automatically terminate power to electrically-operated vacuum pump 118. In one implementation, at least one vacuum-pump cutoff 158 comprises at least one electrical-current-draw detector 160 configured and arranged to detect electrical-current draw of the at least one electrically-operated vacuum pump. Operation of such at least one electrically-operated vacuum pump is terminated by the at least one vacuum-pump cutoff 158 when an electrical-current draw reaches a selected threshold.

[0045] In accordance with an embodiment of the invention, an indirect determination of the first selected pressure level is achieved by timing the duration of the operation of electrically-operated vacuum pump 118. In this arrangement, automatic vacuum-pump cutoff 158 comprises at least one timer 162 structured and arranged to time at least one selected duration of vacuum-pump operation. The selected duration of vacuum-pump operation is determined through mathematical calculation or empirically through physical testing. Timer 162 is configured to supply electrical power to the pump during the selected duration, and terminate the operation of electrically-operated vacuum pump 118 upon elapsing of the selected duration of pump operation.

[0046] In accordance with an embodiment of the invention, determination of the first selected pressure level is achieved by direct sensor-based measurement. In this arrangement, automatic vacuum-pump cutoff 158 comprises at least one pressure sensor 164 (at least embodying herein at least one pressure detector) disposed in fluid-pressure communication with internal storage compartment 104. Pressure sensor 164 is configured to measure the pressure within internal storage compartment 104. Automatic vacuum-pump cutoff 158 is configured to compare measurements from pressure sensor 164 against a pre-selected threshold value. If automatic vacuum-pump cutoff 158 determines that the pressure within internal storage compartment 104 has reached the pre-selected value, the system will automatically terminate power to electrically-operated vacuum pump 118.

[0047] In accordance with an embodiment of the invention, automatic control 156 further comprises at least one automatic vacuum-pump initiator 170 configured to initiate the
operation of electrically-operated vacuum pump 118 when the sub-ambient fluid pressure within internal storage compartment 104 rises to a second selected level.

[0048] Automatic vacuum-pump initiator 170 provides a mechanism for maintaining the sub-ambient fluid pressure within the internal storage compartment(s) 104 within a selected pressure range. This feature can compensate for small pressure losses at re-sealable access openings 108 or other points of leakage within pressure-tight barrier 105. In this arrangement, automatic vacuum-pump initiator 170 is configured to compare pressure measurements from pressure sensor 164 against an upper pre-selected threshold value. If the automatic vacuum-pump cutoff 158 determines that the pressure within internal storage compartment 104 has risen to the pre-selected value, the system can automatically initiate a flow of electrical power to electrically-operated vacuum pump 118. Under appropriate circumstances, considering such issues as cost, user preference, etc., other control arrangements such as, for example, dimensional monitoring of the outer physical volume of the bag, monitoring of elongation within elastic elements of the pressure barrier, etc., may suffice.

[0049] FIG. 6 shows a schematic diagram illustrating manually-actuated pump assembly 116. Manually-operated embodiments of vacuum pump assembly 106 comprise a manually-actuated pump assembly 116 operably coupled to (in fluid communication with) one or more internal storage compartment(s) 104 of compactable travel bag 102. Manually-actuated pump assembly 116 and internal storage compartment(s) 104 can be coupled by a connective pressure line 120. Pressure line 120 may comprise check valve 122 to maintain pressure within internal storage compartment 104 after termination of the operation of the pump.

[0050] In accordance with an embodiment of the invention, manually-actuated pump assembly 116 may comprise a foot-actuated pump assembly 180, which may be deployed from side pocket 115 when needed. In one implementation, the at least one manually-operated vacuum pump comprises at least one foot-operated vacuum pump, and such at least one foot-operated vacuum pump is retractable deployable from such at least one portable container. Under appropriate circumstances, considering such issues as cost, user preference, etc., other manual pump arrangements such as, for example, hand-actuated pumps, pumps actuated by rolling of the bag, pumps actuated by manipulation of the gripping handle, etc., may suffice.

[0051] In accordance with an embodiment of the invention, both the manually-actuated and electrically-actuated embodiments can comprise at least one mechanism for releasing pressure from the compartment. This pressure release mechanism may comprise a dedicated valve, or may simply comprise the opening of the seal used to access the interior of internal storage compartment 104.

[0052] FIG. 7 shows a perspective view illustrating “duffle”-style bag 300, according to another embodiment of the invention. FIG. 8 shows an exploded perspective, view further illustrating the structures and arrangements of bag 300 of FIG. 8. It is noted that bag 300 comprises physical arrangements substantially similar to the embodiment of FIG. 1; thus, only the differences between bag 300 and the prior embodiment will be elaborated upon.

[0053] Bag 300 comprises a soft-sided construction of durable fabric 136 combined with a flexible gas-impermeable membrane 138 (or coating), which is configured to form pressure-tight barrier 105. The soft-sided construction allows bag 300 to deform, thus temporarily reducing the outer volume (physical size) of portions of the device. Bag 300 comprises a rigid or semi-rigid back insert 315 to assist the controlled uniform deformation of the bag structure (as generally illustrated in FIG. 3). Back insert 315 comprises a planar panel integrated into the rear construction of the bag structure.

[0054] Bag 300 also can comprise a wheeled support chassis 332 to facilitate rolling transport of the device (at least embodying herein at least one wheeled chassis structure and arranged to assist wheeled transport of such at least one portable container). Wheeled support chassis 332 comprises at least one extendable hand grip 333 to facilitate manual manipulation by the user.

[0055] Vacuum pump assembly 106 of bag 300 can be protectively housed within an accessible interior compartment of housing assembly 302. In one embodiment, housing assembly 302 is constructed from a relatively lightweight, rigid, and durable material—for example, plastic. Embodiments of housing assembly 302 can be equipped with a set of wheels 304 to facilitate rolling movement of the apparatus.

[0056] Electrically-operated embodiments of bag 300 can include an electrically-operated vacuum pump 118, pump-controller circuit 146, and a retracted power-cord reel 306. Electrically-operated vacuum pump 118, pump-controller circuit 146, and power-cord reel 306 can be housed within housing assembly 302. A removable access cover 308 can be provided to allow convenient access to the above-described components.

[0057] Electrically-operated vacuum pump 118 is operably coupled to (that is, in fluid-pressure communication with) one or more internal storage compartments 104 of bag 300 by at least one connective pressure line 320, as shown (at least embodying herein at least one fluid-pressure conduit structured and arranged to form at least one fluid-pressure connection between such at least one internal storage compartment and such at least one vacuum generator).

[0058] Power-cord reel 306 can incorporate a terminal coupler at one end of a retractable power cord 310, which is adapted to deploy outwardly from the reel and return to a stored position within the reel after use. When outwardly deployed, power cord 310 is configured to be connectable to an external power outlet or other compatible power source. In one arrangement of the system, retractable power cord 310 is adapted to couple to a line-voltage alternating current (A/C) wall outlet. In an alternate arrangement of the invention, retractable power cord 310 is formatted to couple to a powered data port, e.g., a USB data port. Power-cord reel 306 is configured to pass electrical power from the electrical connection to pump-controller circuit 146. When using electrical power at full line voltage, pump-controller circuit 146 comprises an AC/DC converter that is adapted to match the incoming electrical voltage to the voltage requirements of electrically-operated vacuum pump 118.

[0059] FIG. 9 shows an exploded perspective view, illustrating a modified “duffle”-style bag 350 according to an alternate embodiment of the invention. It is noted that bag 350 can comprise physical arrangements substantially similar to the embodiment of FIG. 7; thus, only the differences between bag 350 and the prior bag 300 will be elaborated upon.

[0060] Vacuum pump assembly 106 of bag 350 is protectively housed within an accessible interior compartment of alternate housing assembly 352. In one embodiment of the
invention, alternate housing assembly 352 is integrated within alternate wheeled support chassis 354. Under appropriate circumstances, considering such issues as cost, user convenience, bag geometry, etc., other integration strategies such as, for example, placing a vacuum generator assembly within a compartment or other construction of the bag, the use of manually actuated one-way valves, etc., may suffice.

While there have been shown and described fundamental novel features of the invention as applied to one or more embodiments, it will be understood that various omissions, substitutions, and changes in the form, detail, and operation of these embodiments may be made by those skilled in the art without departing from the spirit and scope of the invention. Substitutions of elements from one embodiment to another are also fully intended and contemplated. The invention is defined solely with regard to the claims appended hereto, and equivalents of the recitations therein.

I claim:

1) A compactable luggage system comprising:
   at least one portable container having at least one internal storage compartment structured and arranged to portably store at least one travel item;
   at least one outer-volume reducer structured and arranged to reduce an outer volume of said at least one portable container;
   said at least one portable container includes:
      at least one pressure-tight barrier structured and arranged to bar equalization of fluid pressures across said at least one pressure-tight barrier surrounding said at least one internal storage compartment; and
      at least one re-sealable access structured and arranged to provide re-sealable access to said at least one internal storage compartment through said pressure-tight barrier;
   said at least one portable container includes at least one pressure-dependent volume adjuster structured and arranged to adjust the outer volume of said at least one portable container in response to at least one fluid pressure differential across said at least one pressure-tight barrier;
   said at least one outer-volume reducer includes:
      at least one vacuum generator structured and arranged to generate the at least one fluid pressure differential by generating at least one sub-ambient fluid pressure within said at least one internal storage compartment; and
      at least one integrator to integrate said at least one vacuum generator within said at least one portable container; and
   wherein generation of the at least one sub-ambient fluid pressure within said at least one internal storage compartment results in a volumetric contraction of said at least one pressure-tight barrier and corresponding reduction in the outer volume of said at least one portable container.

2) The compactable luggage system of claim 1 further comprising at least one wheeled chassis structured and arranged to assist wheeled transport of said at least one portable container.

3) The compactable luggage system of claim 1 wherein said at least one vacuum generator includes at least one manually-operated vacuum pump.

4) The compactable luggage system of claim 4 wherein:
   said at least one manually-operated vacuum pump includes at least one foot-operated vacuum pump; and
   said at least one foot-operated vacuum pump is retractably deployable from said at least one portable container.

5) The compactable luggage system of claim 1 wherein said at least one vacuum generator includes at least one electrically-operated vacuum pump.

6) The compactable luggage system of claim 5 further comprising:
   at least one electric power circuit structured and arranged to conduct electric power to said at least one electrically-operated vacuum pump;
   wherein said at least one electric power circuit comprises at least one control circuit structured and arranged to control the delivery of the electric power to said at least one electrically-operated vacuum pump.

7) The compactable luggage system of claim 6 wherein:
   said at least one electric power circuit comprises at least one onboard electric-power supply structured and arranged to supply the electric power used by said at least one electric power circuit to power said at least one electrically-operated vacuum pump; and
   said at least one onboard electric-power supply is supported by said at least one portable container.

8) The compactable luggage system of claim 6 wherein:
   said at least one electric power circuit comprises at least one electrical coupler structured and arranged to releasably couple said at least one electric power circuit to at least one power source external of said at least one portable container; and
   the electric power derived from the at least one power source external of said at least one portable container is used by said at least one electric power circuit to power said at least one electrically-operated vacuum pump.

9) The compactable luggage system of claim 6 wherein:
   said at least one control circuit comprises at least one user control structured and arranged to enable user control of said at least one electrically-operated vacuum pump.

10) The compactable luggage system of claim 9 wherein:
   said at least one control circuit comprises at least one automatic control structured and arranged to automatically control the operation of said at least one electrically-operated vacuum pump.

11) The compactable luggage system of claim 10 wherein:
   said at least one automatic control comprises at least one vacuum-pump cutoff configured to terminate the operation of said at least one electrically-operated vacuum pump when the at least one sub-ambient fluid pressure, within said at least one internal storage compartment, drops to at least one first selected level.

12) The compactable luggage system of claim 11 wherein:
   said at least one automatic control further comprises at least one vacuum-pump initiator structured and arranged to initiate the operation of said at least one electrically-operated vacuum pump when the at least one sub-ambient fluid pressure, within said at least one internal storage compartment, rises to at least one second selected level.

13) The compactable luggage system of claim 11 wherein:
   said at least one vacuum-pump cutoff comprises at least one electrical-current-draw detector structured and arranged to detect electrical-current draw of said at least one electrically-operated vacuum pump; and
operation of said at least one electrically-operated vacuum pump is terminated by said at least one vacuum-pump cutoff when an electrical-current draw reaches a selected threshold.

14) The compactable luggage system of claim 11 wherein: said at least one vacuum-pump cutoff comprises at least one timer structured and arranged to time at least one selected duration of vacuum pump operation; and said at least one vacuum-pump cutoff is structured and arranged to terminate the operation of said at least one electrically-operated vacuum pump upon elapsing of the at least one selected duration of vacuum pump operation.

15) The compactable luggage system of claim 12 further comprising at least one pressure detector to detect the presence of the at least one selected level and the at least one second selected level within said at least one internal storage compartment.

16) The compactable luggage system of claim 1 further comprising: at least one fluid-pressure conduit structured and arranged to form at least one fluid-pressure connection between said at least one internal storage compartment and said at least one vacuum generator; and disposed within said at least one fluid-pressure conduit, at least one back-check valve structured and arranged to check backward pressure equalization through said at least one vacuum generator when said at least one vacuum generator is not in operation.

17) The compactable luggage system of claim 2 wherein said at least one portable container further comprises: at least one viewable storage structured and arranged to viewably store at least one travel item requiring periodic visual inspection; wherein said at least one viewable storage comprises at least one viewable compartment structured and arranged to compartment therein the at least one travel item requiring periodic visual inspection at least one closable access to provide closable access to said at least one viewable compartment; and at least one transparent portion adapted to provide a view within said at least one viewable compartment from outside said at least one viewable storage, even when said at least one closable access is in a closed position.

18) The compactable luggage system of claim 2 wherein: said at least one viewable compartment is located within said at least one pressure-tight barrier; and said at least one closable access comprises at least one pressure-tight seal when closed.

19) A compactable luggage system to assist compact transport of at least one travel item during travel, said compactable luggage system comprising: at least one airtight-closable enclosure to enclose the at least one travel item; in fluid communication with said at least one airtight-closable enclosure, at least one vacuum source to generate at least one partial vacuum within said at least one airtight-closable enclosure; and at least one wheeled chassis structured and arranged to assist wheeled transport of both said at least one airtight-closable enclosure and said at least one vacuum source; wherein creation of the at least one partial vacuum within said at least one airtight-closable enclosure collapses said at least one airtight-closable enclosure around the at least one travel item; and when collapsed, said at least one airtight-closable enclosure comprises at least one reduced external volume.

20) A compactable luggage system to assist compact transport of at least one travel item during travel, said compactable luggage system comprising: at least one airtight-closable enclosure to enclose the at least one travel item; and in fluid communication with said at least one airtight-closable enclosure, at least one manually-operated vacuum source structured and arranged to generate at least one partial vacuum within said at least one airtight-closable enclosure; and wherein creation of the at least one partial vacuum within said at least one airtight-closable enclosure collapses said at least one airtight-closable enclosure around the at least one travel item; and when collapsed, said at least one airtight-closable enclosure comprises at least one reduced external volume.

21) The compactable luggage system of claim 20 wherein said at least one manually-operated vacuum pump comprises at least one one-foot-operated vacuum pump.

22) A compactable luggage system to assist compact transport of at least one travel item during travel, said compactable luggage system comprising: at least one airtight-closable enclosure to enclose the at least one travel item; at least one outer enclosure to enclose said at least one airtight-closable enclosure; and in fluid communication with said at least one airtight-closable enclosure, at least one vacuum source to generate at least one partial vacuum within said at least one airtight-closable enclosure; wherein creation of the at least one partial vacuum within said at least one airtight-closable enclosure collapses said at least one airtight-closable enclosure around the at least one travel item; and when collapsed, said at least one airtight-closable enclosure compresses the at least one travel item resulting in a reduction of external volume of said at least one airtight-closable enclosure.

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