United States Patent Application Publication	20250261732
Kind Code	A1
Publication Date	August 21, 2025
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LUGGAGE WITH BUILT-IN SCALE

Abstract

A suitcase includes a scale operatively coupled with one or more ground supports that enable a user to determine the current weight of the suitcase and its contents without the need for external equipment. The suitcase can include a display that can show the determined current weight. In embodiments, the suitcase includes a processor that enables functions such as detecting potential theft of contents from the suitcase or the unauthorized introduction of items.

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Family ID: **1000008462896**

Appl. No.: **19/049065**

Filed: **February 10, 2025**

Related U.S. Application Data

us-provisional-application US 63555762 20240220

Publication Classification

Int. Cl.: **A45C5/03** (20060101); **A45C5/14** (20060101); **G01G19/52** (20060101)

U.S. Cl.:

CPC **A45C5/03** (20130101); **A45C5/14** (20130101); **G01G19/52** (20130101);

Background/Summary

[0001] This application claims priority to U.S. provisional application 63/555,762, filed Feb. 20, 2024. U.S. provisional application 63/555,762 and all other extrinsic references contained herein are incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] The field of the invention is luggage technologies.

BACKGROUND

[0003] The background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0004] Every traveler knows the anxiety of trying to stay under an air carrier's baggage weight limit. Packing at home, adding and subtracting items from a suitcase and weighing and re-weighing the suitcase using a common bathroom scale to maximize the items packed without having to pay extra for overweight baggage.

[0005] And then, the traveler gets to the airport and sees that the scale at the airport shows the suitcase is overweight. Thus begins the embarrassing process of opening the suitcase to transfer items out in front of everyone at the check-in line. Or, if that alternative isn't available, simply having to pay overweight fees that can go into the hundreds of dollars.

[0006] Thus, there is still a need for a system that accurately weighs a packed suitcase and provides information to the user such that the user knows with a satisfying certainty how much their suitcase weighs throughout the process of packing, going to the airport, and check-in.

[0007] Additionally, after check-in, there is a risk that something will be taken from the suitcase or, more dangerously, added to the suitcase after it has left the owner's care. Thus, there is a need for a system that can detect changes in the contents of a suitcase when it is no longer in the owner's possession.

[0008] All publications herein are incorporated by reference to the same extent as if each individual publication or patent application were specifically and individually indicated to be incorporated by reference. Where a definition or use of a term in an incorporated reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein applies and the definition of that term in the reference does not apply.

[0009] The following description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0010] In some embodiments, the numbers expressing quantities of ingredients, properties such as concentration, reaction conditions, and so forth, used to describe and claim certain embodiments of the invention are to be understood as being modified in some instances by the term “about.” Accordingly, in some embodiments, the numerical parameters set forth in the written description and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by a particular embodiment. In some embodiments, the numerical parameters should be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of some embodiments of the invention are approximations, the numerical values set forth in the specific examples are reported as precisely as practicable. The numerical values presented in some embodiments of the invention may contain certain errors necessarily resulting from the standard deviation found in their respective testing measurements.

[0011] As used in the description herein and throughout the claims that follow, the meaning of “a,” “an,” and “the” includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of “in” includes “in” and “on” unless the context clearly

dictates otherwise.
[0012] The recitation of ranges of values herein is merely intended to serve as a shorthand method of referring individually to each separate value falling within the range. Unless otherwise indicated herein, each individual value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g. “such as”) provided with respect to certain embodiments herein is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention otherwise claimed. No language in the specification should be construed as indicating any non-claimed element essential to the practice of the invention.
[0013] Groupings of alternative elements or embodiments of the invention disclosed herein are not to be construed as limitations. Each group member can be referred to and claimed individually or in any combination with other members of the group or other elements found herein. One or more members of a group can be included in, or deleted from, a group for reasons of convenience and/or patentability. When any such inclusion or deletion occurs, the specification is herein deemed to contain the group as modified thus fulfilling the written description of all Markush groups used in the appended claims.
SUMMARY OF THE INVENTION
[0014] The inventive subject matter provides apparatus, systems and methods in which a suitcase having a suitcase cavity has one or more scales disposed within the cavity. The scale(s) is connected to one or more of the ground supports (e.g., feet or wheels) of the suitcase. This way, the scale can measure the current weight of the suitcase.
[0015] In embodiments of the inventive subject matter, the suitcase includes a display that is configured to display the current weight determined by the scale(s).
[0016] The suitcase can also include a battery that may be removable, in certain embodiments.
[0017] In embodiments of the inventive subject matter, the suitcase includes a processor. The processor can perform various functions including accounting for the weight of the empty suitcase. In other embodiments, the scale can be pre-calibrated to account for this weight.
[0018] In embodiments, the suitcase includes a sensor attached to a closing mechanism of the suitcase that is configured to detect when the suitcase is opened via the opening of the closing mechanism. In these embodiments, the processor receives a signal from the sensor and causes the scale to determine a new current weight. Then, if the current weight is sufficiently different from one or more previous measurements, the processor causes an alarm to occur that can be indicative of contents being removed or added to the suitcase without authorization.
[0019] Various objects, features, aspects and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

Description

BRIEF DESCRIPTION OF THE DRAWING
[0020] FIG. **1** provides a diagrammatic overview of a suitcase, according to embodiments of the inventive subject matter.
[0021] FIG. **2** illustrates an alternative embodiments where the display is located on the top surface of the suitcase, according to embodiments of the inventive subject matter.
[0022] FIG. **3** illustrates a suitcase according to an alternative embodiment of the inventive subject matter.
[0023] FIG. **4** illustrates an embodiment of the inventive subject matter where the scale is coupled with lateral supports instead of the bottom supports.

[0024] FIG. **5** illustrates a variation of the embodiment of FIG. **4**, with the individual scales discussed with regard to FIG. **3**.
[0025] FIG. **6** illustrates an embodiment with foot supports that have integrated sensors, according to embodiments of the inventive subject matter.
[0026] FIG. **7** shows a detailed exploded view of the assembly of the foot support, according to embodiments of the inventive subject matter.
[0027] FIG. **8** illustrates a suitcase having a sensor on a closing mechanism, according to embodiments of the inventive subject matter.

DETAILED DESCRIPTION

[0028] It should be noted that any language directed to a computer should be read to include any suitable combination of computing devices, including servers, interfaces, systems, databases, agents, peers, engines, controllers, or other types of computing devices operating individually or collectively. One should appreciate the computing devices comprise a processor configured to execute software instructions stored on a tangible, non-transitory computer readable storage medium (e.g., hard drive, solid state drive, RAM, flash, ROM, etc.). The software instructions preferably configure the computing device to provide the roles, responsibilities, or other functionality as discussed below with respect to the disclosed apparatus. In especially preferred embodiments, the various servers, systems, databases, or interfaces exchange data using standardized protocols or algorithms, possibly based on HTTP, HTTPS, AES, public-private key exchanges, web service APIs, known financial transaction protocols, or other electronic information exchanging methods. Data exchanges preferably are conducted over a packet-switched network, the Internet, LAN, WAN, VPN, or other type of packet switched network.
[0029] The following discussion provides many example embodiments of the inventive subject matter. Although each embodiment represents a single combination of inventive elements, the inventive subject matter is considered to include all possible combinations of the disclosed elements. Thus if one embodiment comprises elements A, B, and C, and a second embodiment comprises elements B and D, then the inventive subject matter is also considered to include other remaining combinations of A, B, C, or D, even if not explicitly disclosed.
[0030] FIG. **1** provides a diagrammatic overview of a suitcase **100**, according to embodiments of the inventive subject matter.
[0031] As seen in FIG. **1**, the suitcase includes a suitcase body **110** that defines a cavity **111** within. The suitcase body **110** can include closing mechanisms such as zippers, clasps, latches, or other ways of accessing the cavity **111** as known in the luggage arts.
[0032] At a bottom end of the cavity **111**, the suitcase body **110** includes a scale **120**. The scale **120** is attached to the body **110** and one or more supports **130** (depicted here as a static support **131** and a wheeled support **132**) such that the scale **120** can determine the weight of the suitcase **100** and its contents. The view of FIG. **1** only shows one support **131** and one wheeled support **132**, but it is understood that support **131** can include a second support **131** that is not visible and a second wheeled support **132** that is not visible, so that the suitcase **100** has four supports **130**. It is also understood that in other embodiments, the supports **130** can be entirely wheeled supports **132** or entirely static supports **131**. A mix of both is illustrated here to show that various types of supports **130** are contemplated.
[0033] To do so, the scale **120** is directly coupled with the supports **130** at a bottom end and then elsewhere coupled with the body **110** such that the scale **120** can detect the weight of the suitcase body **110** and its contents relative to the supports **130** when the suitcase **100** is upright.
[0034] This approach allows for the entirety of the suitcase to be weighed when upright, even if the contents within the suitcase are distributed among different compartments within two halves of the suitcase **100**.
[0035] In embodiments of the inventive subject matter, the scale **120** includes an on-board battery that powers the scale **120**. In variations of these embodiments, the battery can be removable such

that the suitcase **100** complies with rules and regulations regarding certain types of batteries in checked luggage.
[0036] The scale **120** also includes a processor that is programmed to perform various functions discussed herein.
[0037] In the embodiment of the inventive subject matter shown in FIG. **1**, the suitcase **100** includes a display **140** communicatively connected with the scale **120**. In preferred embodiments, the display **140** is disposed on the suitcase body **110** such that it is visible from the outside of the suitcase. The display **140** can, in embodiments, be a screen such as an LCD or LED screen. In these embodiments, the display **140** can display the current weight of the suitcase whenever the suitcase **100** is upright and the scale **120** activated.
[0038] In these embodiments, the display **140** can display the exact weight of the suitcase **100** in English and/or metric units. The display **140** can also provide other information such as battery life/status, owner information or other useful information. In embodiments, the display **140** can also change colors in addition to/instead of displaying a weight
[0039] The display **140** can include buttons or be a touchscreen display that allows a user to control certain functions of the scale **120**. For example, the display **140** can include an on/off button that can cause the scale **120** to shut on or shut off. This way, the scale **120** is only activated when the user desires to see the weight of the suitcase **100** and not at other times when the suitcase **100** is upright (such as when moving through an airport, or when the suitcase is in a car or in the process of being loaded into an airplane). Other functions that could be controlled can include displaying the weight in metric or English units, the brightness of the display, setting the weight limit, etc.
[0040] The processor enables a user to enter a weight limit, via the display **140**, that would cause the display **140** to show a message or a color corresponding to an overweight suitcase if the weight exceeds the entered limit. This enables the user to change the display **140** based on a particular air carrier's baggage rules and/or rules associated with particular routes.
[0041] In simplified embodiments of the inventive subject matter, the display **140** can be one or more lights (e.g., LED lights). In these embodiments, the LED lights can be controlled by the scale **120** to provide a first color (e.g., green) if the suitcase is below a particular weight, and a second color (e.g., red) if the suitcase is above a particular weight.
[0042] The scale **120** is programmed to account for the weight of the suitcase **100** itself, including the supports **131**, **132** when determining the total amount of weight. Thus, the scale **120** determines the weight of the suitcase **100** by determining the weight of the contents within the cavity **111** and the suitcase body **110** and adding the predetermined weight of the supports **131**, **132**.
[0043] In embodiments of the inventive subject matter, the suitcase **100** includes a communication interface (e.g., cellular radio, NFC, Bluetooth radio, Wifi, etc.) that is coupled with the processor that enables the processor of the suitcase **100** to communicate with another computing device. For example, a user may have an application installed on their phone that communicates with the processor of the suitcase **100**. This way, the user can see information such as the weight of the suitcase **100** on their phone. In addition, the user can ascertain a location of the suitcase via their phone. The user can also input their flight information into the application which can be shown on display **140**, assisting baggage personnel or others in correctly routing the baggage. The display **140** can also show messages transmitted from the application. For example, if the suitcase **100** is lost by an airline, the display **140** can provide messages such as the user's contact information.
[0044] The processor can be arranged at different locations within the suitcase based on considerations such protecting the processor and associated circuitry, ease of connectivity with other components within the suitcase **100**, ease of repair, etc. In the embodiments shown herein, the processor is considered to be integral to the display unit **140**. In other embodiments,
[0045] FIG. **2** illustrates an alternative embodiments where the display **140** is located on the top surface of the suitcase **100**. This way, the display **140** can easily be read from above when the suitcase is standing. In the rest of the embodiments, the display **140** is shown as being on the top

surface of the suitcase **100**. However, it is contemplated that the display **140** could be on the side or any other surface of the suitcase **100**. Additionally, it is contemplated that the suitcase **100** can have more than one display **140**.

[0046] FIG. **3** illustrates an alternative embodiment of the inventive subject matter. In this embodiment, individual scales **120** are attached to each of the supports **131**, **132**. In this embodiment, each scale sends their measurements to the processor that then determines the total weight of the suitcase. In these embodiments, the processor can be programmed to only calculate a weight when it receives signals from all of the individual scales **120**, so that it does not waste resources calculating a false weight based on signals from only some of the scales **120** (such as when the suitcase **100** is being rolled on two wheels during transit).

[0047] FIG. **4** illustrates an embodiment of the inventive subject matter where the scale **120** is coupled with lateral supports **133**, **134** instead of the bottom supports **131**, **132**. This way, the scale **120** is activated when the suitcase **100** is on its side.

[0048] FIG. **5** illustrates a variation of the embodiment of FIG. **4**, with the individual scales **120** discussed with regard to FIG. **3**.

[0049] In the embodiments of FIGS. **1**, **2** and **5**, the scale **120** can be two scales **120** that each communicate with the processor, each scale **120** handling two supports **130**. In these embodiments, the scales **120** are aligned with each half of the suitcase **100** such that the suitcase **100** can be opened normally.

[0050] In other embodiments of FIGS. **1**, **2** and **5**, the scale **120** has a surface that is separable such that when the suitcase **100** is opened, the surface of scale **120** separates such that a section of the scale **120** remains in each half of the suitcase **100**. When the suitcase **100** is closed again, the scale **120** comes back together and can perform the functions discussed herein.

[0051] As used herein, and unless the context dictates otherwise, the term “coupled to” is intended to include both direct coupling (in which two elements that are coupled to each other contact each other) and indirect coupling (in which at least one additional element is located between the two elements). Therefore, the terms “coupled to” and “coupled with” are used synonymously.

[0052] FIG. **6** illustrates an embodiment with foot supports **631** that have integrated sensors, according to embodiments of the inventive subject matter.

[0053] In the illustrated example of FIG. **6**, the supports **631** are on the same side as hinges **610**, and as such the arrangement is staggered relative to one another such that the supports **631** do not interfere with each other when the suitcase **100** is opened. Other arrangements of the supports **631** are contemplated for distribution on this and/or other sides of the suitcase **100**.

[0054] FIG. **7** shows a detailed exploded view of the assembly of foot support **631**, according to embodiments of the inventive subject matter. As seen in FIG. **7**, the foot support **631** includes a cover **632**, a weight sensor **633** that is disposed between the cover **632** and sensor base **634**. The footpad **635** is in contact with the weight sensor **633**, such that the weight of the suitcase **100** presses the footpad **635** against the weight sensor **633**. In embodiments of the inventive subject matter such as the one shown herein, the support **631** can also include a reinforcement element **636** that can be made of a sufficiently stiff material (e.g., iron or other metal, a hard plastic material, a hard rubber, etc.).

[0055] In embodiments of the inventive subject matter, the sensor **633** is a gravity sensor that converts the force exerted due to gravity acting on the suitcase (i.e., the weight of the suitcase) into electrical signals that are then transmitted to the processor for the various functions discussed herein.

[0056] The sensor base **634** is used to fix the various components of the foot support **631** to the body **110** of the suitcase **100**. The sensor **633** is then affixed in place by the combination of the cover **632** and base **634**. The inclusion of the reinforcement element **636** can improve the accuracy of weighing operations.

[0057] In the embodiment of FIGS. **6-7**, the foot pad **635** contacts the ground and the force of the

weight from the suitcase **100** is “passed” upward to the sensor **633** via the reinforcement member/element **636**.
[0058] In embodiments of the inventive subject matter, the suitcase can include the ability to detect tampering with the suitcase when the suitcase is not in the owner's possession (such as after the suitcase has been checked at the check-in counter).
[0059] In embodiments of the inventive subject matter, the processor of scale **120** can be programmed to periodically take weight measurements. This can be in response to a user input setting the suitcase to a “tamper-detect” mode that begins the periodic measurements. If the weight sensor detects a change in weight above a certain threshold, it can communicate an alert to the user. In embodiments of the inventive subject matter, the processor can be programmed to determine whether the weight change is above a second threshold. If it is above a second threshold, it can ignore the change. This greater weight threshold could correspond to a weight that would be above the limit of the suitcase **100**, which could then correspond to something heavy placed on top of the suitcase **100** (e.g., another piece of luggage within an aircraft's baggage hold).
[0060] While the embodiment above can be useful in detecting tampering, the possibility of false positives remains elevated because of the variability in the weight of the contents of the suitcase (lightly packed versus heavily packed) and how the suitcase **100** could be handled at an airport, or packed into an aircraft.
[0061] FIG. **8** illustrates an embodiment of the inventive subject matter that solves these challenges. In the embodiment of FIG. **8**, the suitcase **100** includes a sensor **801** disposed on the zipper, latch, or other closing/securing mechanism **802** that can detect when the suitcase **100** is opened.
[0062] The sensor **801** can be a magnetic sensor that detects when two matching zipper
[0063] components are separated by a certain amount (when the closing mechanism **802** is a zipper), or that detects when the two corresponding pieces of a latch lock (such as the one illustrated in FIG. **8**) are separated from each other. Other sensors that can be used to detect an opening of a latch, lock, zipper, etc are contemplated as well.
[0064] In these embodiments of the inventive subject matter, the processor detects, via sensor **801**, when the closing mechanism **802** has been opened. Based on this signal, the processor then determines, via scale **120**, the weight of the suitcase. If the weight varies from a prior determination by more than a threshold amount, the processor causes an alert to be sent via a wireless transmission to a computing device of the user (e.g., via Wifi, cellular, NFC, etc.).
[0065] Thus, at some time prior, the scale **120** determines the weight of the suitcase such as due to a user command or a periodic weighing. Then, in response to the signal from sensor **801**, the processor causes the scale **120** to detect a current weight. The processor then compares the current weight to the most recent prior weight (can be the single most recent, or a plurality of recent measurements) and determines whether the current weight varies from the most recent prior weight(s) by an amount greater than the threshold amount. If so, the processor causes an alert to be sent to the owner's computing device.
[0066] In variations of these embodiments, the alert sent by the processor to the user can vary depending on how the weight varied. If the current weight is under the previous weights by more than the threshold amount, the alert can indicate that the weight of the suitcase **100** has decreased and can also indicate a possible theft. If the current weight is over the previous weight by more than the threshold amount, the alert can indicate that the weight of the suitcase **100** has increase and indicate that an unknown item has been introduced into the suitcase **100**.
[0067] The alert can be in the form of a text/MMS message, an email, a social media message, an automated phone call, an alert on a dedicated application, or any other method of sending a message.
[0068] In embodiments of the inventive subject matter, the alert can also include a message on the display **140**. The message can be/can include flashing of the display **140** to raise attention to the

suitcase **100**. In embodiments of the inventive subject matter, the suitcase **100** can include one or more speakers (e.g., within the housing of display **140** or other part of the suitcase), that can raise an audible alarm in response to an alert being determined.

[0069] It should be apparent to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms “comprises” and “comprising” should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refers to at least one of something selected from the group consisting of A, B, C . . . and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

Claims

1. A suitcase comprising: a suitcase body, within which is disposed a suitcase cavity; at least one support attached to a bottom of the suitcase body; and a scale disposed within a bottom end of the suitcase cavity, the scale operatively coupled with the at least one support such that the scale can measure a current weight of the suitcase when the suitcase body is rested on the at least one support.

2. The suitcase of claim 1, wherein the at least one support comprises four supports.

3. The suitcase of claim 2, wherein at least two of the four supports comprise wheeled supports.

4. The suitcase of claim 1, wherein the scale further comprises a battery.

5. The suitcase of claim 4, wherein the battery comprises a removable battery.

6. The suitcase of claim 1, further comprising a display communicatively coupled with the scale.

7. The suitcase of claim 1, further comprising a processor programmed to: determine a weight value corresponding to the current weight obtained from the scale; and add a predetermined weight of the suitcase to the weight value.

8. The suitcase of claim 1, further comprising: a processor; a closing mechanism; and a sensor configured to detect an opening of the closing mechanism, wherein the sensor is communicatively coupled with the processor; wherein the processor is programmed to: receive a signal from the sensor indicating that the closing mechanism has been opened; cause the scale to measure the current weight; compare the current weight to at least one past weight measurement; determine whether the comparison results in a weight difference greater than a threshold; and based on the determination, report an alarm.

9. The suitcase of claim 8, further comprising a wireless communication interface coupled to the processor, wherein the processor programmed to report an alarm further comprises sending, via the wireless communication interface, a message to a computing device.

10. The suitcase of claim 9, wherein the message comprises at least one of a text message, an audio message, a video message, an email, or a notification via an application.

11. The suitcase of claim 8, wherein the suitcase comprises a display coupled to the processor, and wherein the processor programmed to report an alarm further comprises the processor programmed to cause a display of an alarm message on the display.