PUSH-PULL WHEELED LUGGAGE WITH SWINGABLE REAR WHEELS AND AT LEAST ONE FIXED FRONT WHEEL

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ABSTRACT

A wheeled luggage is configured to be pushed or pulled using a handle attached to the wheeled luggage. This "push-pull" wheeled luggage has a main luggage body with one or more swingable rear wheels at a rear edge of a lower portion of the main luggage body, and one or more fixed front wheels in front of the one or more swingable rear wheels. Each front wheel has an elongated neck attached to a front lower portion of the main luggage body, which creates a backward tilt due to a higher ground clearance in the front lower portion. Each swingable rear wheel is configured to receive a directional force to steer the push-pull wheeled luggage. The backward tilt created by the elongated neck attached to the front lower portion of the main luggage body enables a user to push the push-pull wheeled luggage ergonomically by applying a forward-downward force to the handle.
Fig. 2
PUSH-PULL WHEELED LUGGAGE WITH SWINGABLE REAR WHEELS AND AT LEAST ONE FIXED FRONT WHEEL

BACKGROUND

[0001] This invention generally relates to luggage. In particular, the invention relates to a novel wheeled luggage that reduces the user’s burden of lifting a portion of the wheeled luggage during transportation.

[0002] Wheeled luggage is a common method of carrying items for shippers and travelers. One common type of wheeled luggage is a “pullman” case. There are several variations of pullman cases. One type of pullman cases has two fixed wheels located in the bottom-rear portion and a pair of plastic legs in the bottom-front portion of the case. This type of pullman case also has a handle or a strap located in the front portion of the case. A user is required to “pull” the case by lifting the front portion of the case and pulling the case forward. The pullman case can either have a solid or flexible caging. One disadvantage of the pullman case is that the user has to lift the front portion of the case with a handle and then pull the case forward, which requires a directly proportional amount of pulling force relative to the weight of the case. Therefore, for pullman cases, increased weight of luggage requires a proportionally increased amount of pulling force from the user.

[0003] Another common type of pullman case has four wheels at the bottom of the case. They are designed to be pulled like a wagon with a handle or a strap in the front portion of the case. In order to pull the case ergonomically, the handle or the strap of the four-wheeled pullman is diagonally upward from the front portion of the case because a user is typically taller than the case. A Newtonian physics force diagram for the required diagonally-upward force suggests that the user is essentially lifting a portion of the weight of the case (i.e., a vertical vector component from the diagonally upward vector representing the net force). Therefore, heavier pullman cases assert substantial strain on the user’s arm during transportation. As a real-world example, this drawback is apparent to a user in a heavy pullman-type luggage at a large airport, where the user may be required to roll the luggage across hundreds or thousands of yards.

[0004] Therefore, a novel wheeled luggage which substantially reduces the stress on a user’s arm is highly desirable.

SUMMARY

[0005] A push-pull wheeled luggage case is configured to be pushed and pulled by a user using a handle attached to the push-pull wheeled luggage case. The push-pull wheeled luggage case comprises a main luggage body with a higher ground clearance in front relative to rear of the main luggage body, wherein the main luggage body is configured to contain items inside, one or more swingable rear wheels located at a rear lower portion of the main luggage body, wherein each swingable rear wheel is configured to change its direction based on a user’s directional force applied to the handle attached to the luggage case, and one or more fixed front wheels located in front of the one or more swingable rear wheels, wherein an elongated neck for each fixed front wheel attached to a front lower portion of the main luggage body provides the higher ground clearance relative to the one or more swingable rear wheels at the rear lower portion of the main luggage body, thereby tilting the main luggage body backward when the one or more swingable rear wheels and the one or more fixed front wheels are touching a flat surface.

BRIEF DESCRIPTION OF DRAWINGS

[0006] FIG. 1 shows a user pushing a push-pull wheeled luggage in accordance with one or more embodiments of the invention.
[0007] FIG. 2 shows a user pulling a push-pull wheeled luggage in accordance with one or more embodiments of the invention.
[0008] FIG. 3 shows a bottom portion of a push-pull wheeled luggage in accordance with one or more embodiments of the invention.
[0009] FIG. 4 shows a bottom portion of a push-pull wheeled luggage in accordance with one or more embodiments of the invention.
[0010] FIG. 5 shows a laid-down side view of a push-pull wheeled luggage in accordance with one or more embodiments of the invention.

DETAILED DESCRIPTION

[0011] Specific embodiments of the invention will now be described in detail with reference to the accompanying figures. Like elements in the various figures are denoted by like reference numerals for consistency.

[0012] In the following detailed description of embodiments of the invention, numerous specific details are set forth in order to provide a more thorough understanding of the invention. However, it will be apparent to one of ordinary skill in the art that the invention may be practiced without these specific details. In other instances, well-known features have not been described in detail to avoid unnecessarily complicating the description.

[0013] In general, embodiments of the invention relate to an apparatus for carrying items in a luggage. More specifically, embodiments of the invention relate to a wheeled luggage, called a “push-pull” luggage, which can be used for a “push mode” and a “pull mode” by the user using a handle attached to the wheeled luggage.

[0014] Furthermore, embodiments of the invention enable the user to move the push-pull wheeled luggage in a push mode with significantly less effort than in a pull mode. More specifically, the invention alleviates the user from lifting a portion of the weight of the push-pull wheeled luggage by tilting the luggage backward (i.e., towards the user) and incorporating one or more “swingable” rear wheels and one or more longer-necked fixed front wheels attached to a lower portion of the push-pull wheeled luggage.

[0015] In one embodiment of the invention, each swingable rear wheel is configured to rotate horizontally around a neck of the swingable rear wheel attached to a bottom portion of the push-pull wheeled luggage. The tilting of the push-pull wheeled luggage is achieved by using an elongated neck for each fixed front wheel, thereby creating a higher front ground clearance than a rear ground clearance provided by the swingable rear wheels.

[0016] FIG. 1 shows a user (111) pushing a push-pull wheeled luggage (103) with one or more swingable rear wheels (106) and one or more fixed front wheels (113) in accordance with one embodiment of the invention. This activity is defined as the “push mode.”

[0017] In one embodiment of the invention, the one or more fixed front wheels (113) provide a linear stability to move-
The invention of the push-pull wheeled luggage (103) and the one or more swingable rear wheels (106) provides a directional and steering capability to the push-pull wheeled luggage (103) depending on the user’s applied force on a handle (102) attached to the push-pull wheeled luggage (103) via one or more support bars (101). It is important to note that the push-pull wheeled luggage (103) is tilted backward (i.e. towards the user (111)) because an elongated neck (105) for each fixed front wheel (113) creates a higher front ground clearance than a rear ground clearance for the push-pull luggage (103). The elongated neck (105) typically contains an axis of wheel rotation to roll each fixed front wheel (113).

A circled area (6) shows an angle of contact by the one or more fixed front wheels (113) to a flat surface. In one embodiment of the invention, the one or more fixed front wheels (113) and corresponding elongated necks (105) form a perpendicular contact to the flat surface. In another embodiment of the invention, the one or more fixed front wheels (113) and the corresponding elongated necks (105) form a non-perpendicular contact to the flat surface. In general, the angle of contact to the surface for the one or more fixed front wheels and the corresponding elongated necks (105) do not inhibit the directional and steering capability provided by the one or more rear swingable wheels (106).

A user need not lift a portion of the weight of the push-pull wheeled luggage. Over long distances, this force advantage results in superior usability and efficiency for movement of the push-pull wheeled luggage. Ease of movement of the push-pull wheeled luggage during the pull mode is a key feature of the invention.

FIG. 2 shows a user (211) lifting one or more fixed front wheels (206) from a surface and pulling a push-pull wheeled luggage (203) using one or more swingable rear wheels (210) by applying a forward-upward force, $F_{x_2}$ (209), in accordance with the invention. This activity is defined as the “pull mode”.

In one embodiment of the invention, the one or more swingable rear wheels (210) provide a directional and steering capability to the movement of the push-pull wheeled luggage (203). Unlike the pull mode, the pull mode requires the user (211) to apply the forward-upward force, $F_{x_2}$ (209), to a handle (202) attached to the push-pull wheeled luggage via one or more support bars (201). Applying the forward-upward force, $F_{x_2}$ (209), necessitates the user (211) to lift a portion of the weight of the push-pull wheeled luggage (203). A simple Newtonian physics vector diagram (207, 208, 209) demonstrates this added burden to the user (211) for the pull mode. The net force applied by the user (211) is illustrated by a vector, $F_{x_2}$ (209), which can be broken down into components, a horizontal vector, $F_{x_2}$ (207), and a vertical vector, $F_{y_2}$ (208). The horizontal vector, $F_{x_2}$ (207), is responsible for the pull-pushed wheeled luggage (203) forward. The vertical vector, $F_{y_2}$ (208), essentially requires the user (211) to lift up a portion of the weight of the push-pull wheeled luggage (203). In essence, lifting up the portion of the weight of the push-pull wheeled luggage (203) is inefficient and unnecessary (i.e. in light of the pull mode described for FIG. 1), but it is an inherent force required in the pull mode.

In the pull mode, there is an engineering motivation for tilting the push-pull wheeled luggage (103) backward (i.e. towards the user (111)) in accordance with the invention. If the push-pull wheeled luggage (103) were not tilted backward and instead remained orthogonal to the flat surface, it is ergonomically difficult to apply any horizontal force $F_{x_1}$ (107) to the push-pull wheeled luggage (103) using the handle (102) without tipping the push-pull wheeled luggage (103). A simple vector component diagram of a net force provided by the user, $F_{y_2}$ (109), shows a clear advantage of tilting the push-pull wheeled luggage (103) backward when the user decides to apply a diagonal forward-downward force, $F_{x_2}$ (109), to the handle. A simple Newtonian physics vertical and horizontal vector analysis shows that a horizontal vector, $F_{x_1}$ (107), provides a forward directional push to the push-pull wheeled luggage (103). A vertical vector, $F_{y_2}$ (108), on the other hand, provides a downward force to the one or more swingable rear wheels (106) and the one or more fixed front wheels (113), thereby helping stability of the push-pull wheeled luggage (103) when the user (111) applies $F_{x_2}$ (109).

An inherent advantage of the present invention comes from the pull mode of the push-pull wheeled luggage (103). Unlike a pull mode, in which the user is forced to lift a portion of the weight of the push-pull wheeled luggage, the push mode benefits from an inherent advantage in laws of physics. By applying the diagonal forward-downward force (i.e. pull mode) instead of a forward-upward force (i.e. pull mode), the user leverages gravity and does not have to lift a portion of the weight of the push-pull wheeled luggage. Over long distances, this force advantage results in superior usability and efficiency for movement of the push-pull wheeled luggage. Ease of movement of the push-pull wheeled luggage during the pull mode is a key feature of the invention.

FIG. 3 shows a bottom surface of a push-pull wheeled luggage (303) in accordance with one or more embodiments of the invention. In this particular embodiment, a pair of swingable rear wheels (304) provides a directional and steering capability to the push-pull wheeled luggage (303) for both the push and pull modes as described in FIG. 1 and FIG. 2. A fixed front wheel (301) is located in front of the pair of swingable rear wheels (304). In one or more embodiments of the invention, the fixed front wheel (301) is roughly equidistant from each swingable rear wheel (304) and forms a geometrical configuration similar to a tricycle.

Continuing with FIG. 3, the term “swingable” defines the horizontal circular movement of the pair of swingable rear wheels (304), as shown by arrows (302). The pair of swingable rear wheels (304) can be attached to a rear portion of the push-pull wheeled luggage (303) by riveting, drilling, or bolting swingable necks (306) into the bottom surface of the push-pull wheeled luggage (303). Similarly, the fixed front wheel (301) can be attached to a front portion of the push-pull wheeled luggage (303) by riveting, drilling, or bolting.
ing an elongated neck (305) into the bottom surface of the push-pull wheeled luggage (303). This tricycle-like configuration on the bottom surface of the push-pull wheeled luggage (303) is a preferred embodiment of the invention.

[0028] FIG. 4 shows a bottom surface of a push-pull wheeled luggage (403) in accordance with one or more embodiments of the invention. In this particular embodiment, a pair of swingable rear wheels (404) provides a directional and steering capability to the push-pull wheeled luggage (403) for both push and pull modes as described in FIG. 1 and FIG. 2. A pair of fixed front wheels (405) is located in front of the pair of swingable rear wheels (404). In one or more embodiments of the invention, this four-wheel configuration is optimal for supporting a heavier weight of the push-pull wheeled luggage (403) compared to the tricycle-like configuration of the push-pull wheeled luggage (303) described in FIG. 3.

[0029] Continuing with FIG. 4, the term “swingable” defines the horizontal circular movements of the pair of swingable rear wheels (404), as shown by arrows (402). The pair of swingable rear wheels (404) can be attached to a rear portion of the bottom surface of the push-pull wheeled luggage (403) by riveting, drilling, or bolting swingable necks (401) into the bottom surface of the push-pull wheeled luggage (403). Similarly, the pair of fixed front wheels (405) can be attached to a front portion of the bottom surface of the push-pull wheeled luggage (403) by riveting, drilling, or bolting elongated necks (406) into the bottom surface of the push-pull wheeled luggage (403).

[0030] FIG. 5 shows a laid-down view of a push-pull wheeled luggage (501) in accordance with one or more embodiments of the invention. In this particular embodiment, a support bar (504) typically houses a retractable handle (505), from which a user exerts pushing or pulling force to the push-pull wheeled luggage (501). The support bar (504) and the retractable handle (505) are typically made of metal or plastic. In one embodiment, one or more swingable rear wheels (507) can be held together by one or more swingable necks (506) which are typically riveted, drilled, or bolted on to a lower rear portion of the push-pull wheeled luggage (501). Similarly, one or more fixed front wheels (502) can be held together by one or more elongated necks (503), which are typically riveted, drilled, or bolted on to a lower front portion of the wheeled luggage (501).

[0031] While the invention has been described with respect to a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that other embodiments can be devised which do not depart from the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the attached claims.

What is claimed is:

1. A push-pull wheeled luggage case configured to be pushed and pulled by a user using a handle attached to the push-pull wheeled luggage case, the push-pull wheeled luggage case comprising:
   a main luggage body with a higher ground clearance in front relative to rear of the main luggage body, wherein the main luggage body is configured to contain items inside;
   a pair of swingable rear wheels located at a rear lower portion of the main luggage body, wherein each swingable rear wheel is configured to rotate around a vertical axis for a horizontally circular swinging motion based on a directional force applied by the user;
   a fixed front wheel located in front of the pair of swingable rear wheels, wherein an elongated neck of the fixed front wheel attached to a front lower portion of the main luggage body provides the higher ground clearance in the front relative to the rear of the main luggage body, thereby tilting the main luggage body backward when the pair of swingable rear wheels and the fixed wheel are touching a flat surface.

2. The push-pull wheeled luggage case of claim 1, wherein tilting the main luggage body backward means that the main luggage body is tilted towards the user standing behind the push-pull wheeled luggage case.

3. The push-pull wheeled luggage case of claim 1, wherein the vertical axis for the horizontally circular swinging motion for each swingable rear wheel is provided by a swingable neck attached to the rear lower portion of the main luggage body.

4. The push-pull wheeled luggage case of claim 1, wherein each swingable rear wheel of the pair of swingable rear wheels is located at each corner of the rear lower portion of the main luggage body.

5. The push-pull wheeled luggage case of claim 1, wherein the pair of swingable rear wheels enables the user to push the push-pull wheeled luggage case to a desired direction by applying a diagonal forward-downward force on the handle of the push-pull wheeled luggage case and wherein the fixed front wheel located in front of the swingable rear wheels provides a straight-line stability.

6. The push-pull wheeled luggage case of claim 2, wherein the push-pull wheeled luggage case can be pulled by the user by further tilting the main luggage body towards the user, thereby detaching the fixed front wheel from the flat surface and relying only on the pair of swingable rear wheels for pulling movement of the push-pull wheeled luggage case.

7. A push-pull wheeled luggage case configured to be pushed and pulled by a user using a handle attached to the push-pull wheeled luggage case, the push-pull wheeled luggage case comprising:
   a main luggage body with a higher ground clearance in front relative to rear of the main luggage body, wherein the main luggage body is configured to contain items inside;
   one or more swingable rear wheels located at a rear lower portion of the main luggage body, wherein each swingable rear wheel is configured to change its direction based on a user’s directional force applied to the handle attached to the luggage case; and
   one or more fixed front wheels located in front of the one or more swingable rear wheels, wherein an elongated neck for each fixed front wheel attached to a front lower portion of the main luggage body provides the higher ground clearance relative to the one or more swingable rear wheels at the rear lower portion of the main luggage body, thereby tilting the main luggage body backward when the one or more swingable rear wheels and the one or more fixed front wheels are touching a flat surface.

8. The push-pull wheeled luggage case of claim 7, wherein tilting the main luggage body backward means that the main luggage body is tilted towards the user standing behind the push-pull wheeled luggage case.
9. The push-pull wheeled luggage case of claim 7, wherein the one or more swingable rear wheels are located near at least one corner of the rear lower portion of the main luggage body.

10. The push-pull wheeled luggage case of claim 7, wherein the one or more swingable rear wheels enable the user to push the push-pull wheeled luggage case to a desired direction by applying a diagonal forward-downward force on the handle of the push-pull wheeled luggage case and wherein the one or more fixed front wheels located in front of the swingable rear wheels provide a straight-line stability.

11. The push-pull wheeled luggage case of claim 8, wherein the push-pull wheeled luggage case can be pulled by the user by further tilting the main luggage body towards the user, thereby detaching the one or more fixed front wheels from the flat surface and relying only on the one or more swingable rear wheels for pulling movement of the push-pull wheeled luggage case.

12. A push-pull wheeled luggage case configured to be pushed and pulled by a user using a handle attached to the push-pull wheeled luggage case, the push-pull wheeled luggage case comprising:
   a main luggage body with a higher ground clearance in front relative to rear of the main luggage body, wherein the main luggage body is configured to contain items inside;
   one or more swingable rear wheels located at a rear lower portion of the main luggage body, wherein each swingable rear wheel is configured to change its direction based on a user's directional force applied to the handle attached to the luggage case;
   a plurality of fixed front wheels located in front of the one or more swingable rear wheels, wherein an axle going through the plurality of fixed front wheels provides a common axis of rotation for the plurality of fixed front wheels;
   one or more elongated necks attached to the plurality of fixed front wheels and a front lower portion of the main luggage body, wherein the one or more elongated necks for the plurality of fixed front wheels provide a higher ground clearance relative to the one or more swingable rear wheels at the rear lower portion of the main luggage body, thereby tilting the main luggage body backward when the one or more swingable rear wheels and the plurality of fixed front wheels are touching a flat surface.

13. The push-pull wheeled luggage case of claim 12, wherein tilting the main luggage body backward means that the main luggage body is tilted towards the user standing behind the push-pull wheeled luggage case.

14. The push-pull wheeled luggage case of claim 12, wherein the one or more swingable rear wheels are located near at least one corner of the rear lower portion of the main luggage body.

15. The push-pull wheeled luggage case of claim 12, wherein the one or more swingable rear wheels enable the user to push the push-pull wheeled luggage case to a desired direction by applying a diagonal forward-downward force on the handle of the push-pull wheeled luggage case and wherein the plurality of fixed front wheels located in front of the swingable rear wheels provide a straight-line stability.

16. The push-pull wheeled luggage case of claim 13, wherein the push-pull wheeled luggage case can be pulled by the user by further tilting the main luggage body towards the user, thereby detaching the plurality of fixed front wheels from the flat surface and relying only on the one or more swingable rear wheels for pulling movement of the push-pull wheeled luggage case.

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