Abstract: A power trolley system suitable for carrying cans can be controlled by a carrier control unit (82). The control unit (82) can comprise a processor operable to receive via a wireless channel position data describing a present position of the carrier within a power trolley system; receive via the wireless channel target position data describing a target position for the carrier within the power trolley system; receive via the wireless channel distance data describing a relative position of a further carrier within the power trolley system; and provide movement control data to a drive unit to cause the carrier to move from the present position to the target position.
POWER TROLLEY TRANSPORT SYSTEM

FIELD
The present invention relates to transport and in particular, but not exclusively, to power trolley systems for airports and other applications. However, it will be appreciated that the invention is not limited to this particular field of use.

BACKGROUND
The inventors have previously developed a system (described in patent application no GB08021 19.8) which ingeniously uses a power trolley system within the context of a baggage handling system for an airport or similar facility. In so doing, a number of limitations of "off the shelf" power trolley systems have become apparent in a way which has not been revealed by the previous uses for power trolley systems.

The present invention has been made, at least in part, in consideration of the problems and drawbacks of conventional systems.

SUMMARY
According to a first aspect, there can be provided a power trolley system carrier control unit comprising: a processor operable to: receive via a wireless channel position data describing a present position of the carrier within a power trolley system; receive via the wireless channel target position data describing a target position for the carrier within the power trolley system; receive via the wireless channel distance data describing a relative position of a further carrier within the power trolley system; and provide movement control data to a drive unit to cause the carrier to move from the present position to the target position. Thereby a rapid provision and updating of necessary location information can be performed to and from a carrier within a power trolley system such that high speed carrier movement can be achieved.

In some embodiments the unit can further comprise a position detector operable to detect the present position and to provide the position data to the processor. Thus the position of a carrier can be self-detected and checked against the target position data to determine whether the target position has been reached without recourse to a remote control unit. In some arrangements, the position detector is operable to detect the present position by reading a location code provided along the power trolley system. The location code can be a barcode provided along a rail or track of the power trolley system which provides a continuous position coding along the length of the power trolley transit network. The location code can be provided by a
plurality of RFID tags along the power trolley system which can provide continuous or
near-continuous position coding along the length of the power trolley transit network.

In some embodiments the unit can further comprise a distance detector operable to
detect a distance to a further carrier and to provide the distance data to the
processor. Thus each carrier can update for itself the distance information describing
the distance to the next-nearest carrier, thus providing (among other things) a
mechanism for a collision avoidance failsafe in case position updates to relative
position date are not received in time to prevent a collision. In some arrangements,
the distance detector can be operable to detect a distance to a closest further carrier
in a current movement direction of the carrier. The distance detector can be an
optical detector operable to detect a distance by means of an observed image size.
Alternatively the distance detector can be an optical or ultrasound detector operable
to detect a distance by means of a signal time of flight analysis.

In some embodiments the unit can further comprise an antenna operable to receive
via the wireless channel data describing the target position from an external control
and to provide the target position data to the processor. Thus an antenna can be
provided to interface between the wireless channel and the processor. In some
arrangements, the antenna can be further operable to transmit the present position
data to an external control via the wireless channel. Thus a position update can be
provided to the control to enable overall rout-planning and collision avoidance for
multiple trolleys.

In some examples, the antenna can be operable to transmit signals to and receive
signals via the wireless channel from a signal carrier along the power trolley system.
Thus the wireless channel can be provided localised to the transit network of the
system. In some arrangements, the signal carrier can comprise a plurality of access
points disposed around the power trolley system. In other arrangements, the signal
carrier can comprise a leaky coax cable along a track or rail of the power trolley
system. Thus a highly localised transmit/receive arrangement for the wireless
channel can be provided, thereby minimising the part of the communications channel
which is wireless.

In some examples, the data to be received via the antenna can include data
describing one or more of a movement speed, a load status and a load type from a
central control. Thus the intended movement speed for the carrier and/or the status
of the carrier load can be provided to the unit so as to be taken into account during
movement. For example, a rate of acceleration may be set according to one or more
of the intended speed and load characteristics.
In some embodiments, the unit can further comprise a drive unit operable to receive the movement control data from the processor and to control a drive motor in accordance therewith. In some arrangements, the drive unit is operable to control the drive motor to achieve a movement speed in accordance with speed instructions received by the unit from an external control. The movement speed may be up to at least 2.5 ms⁻¹. Thus rapid movement can be achieved, under the control of a central control if required. In some examples, the movement speed defined in the speed instructions is dependent upon a load status of the carrier. Thus full carriers can be caused to move more slowly or more fast than empty carriers.

Viewed from another aspect, there can be provided a power trolley system carrier which includes a control unit as previously set out. The carrier can include a drive motor.

Viewed from a further aspect, there can be provided a power trolley system comprising a plurality of carriers as previously set out. The system can include a control operable to control the movement of the plurality of carriers.

Viewed from another aspect, there can be provided a method of controlling carriers within a power trolley system, the method comprising: receiving at a carrier control processor via a wireless channel position data describing a present position of the carrier within a power trolley system; receiving at the carrier control processor via the wireless channel target position data describing a target position for the carrier within the power trolley system; receiving at the carrier control processor via the wireless channel distance data describing a relative position of a further carrier within the power trolley system; and providing movement control data from the carrier control processor to a drive unit to cause the carrier to move from the present position to the target position. Thereby a rapid provision and updating of necessary location information can be performed to and from a carrier within a power trolley system such that high speed carrier movement can be achieved.

Viewed from a further aspect, there can be provided a power trolley system comprising: a central control operable to, for each of a plurality of carriers, transmit data describing current position, target position and next carrier distance to the trolley via a channel including a wireless channel segment; a transit route network operable to carry thereon a plurality of carriers and having co-located therewith a leaky coax cable to provide signal carriage for a non-wireless segment of the channel and to provide signal radiation for the wireless segment of the channel; a plurality of carriers, each operable to receive via the wireless channel segment the data describing current position, target position and next trolley distance and to move along the transit route network to the target position. Thereby a rapid provision and
updating of necessary location information can be performed in a reliable manner with minimum opportunity for data loss in the wireless channel to and from a carrier within a power trolley system such that high speed carrier movement can be achieved.

In some embodiments, the transit route network also has co-located therewith a carrier-readable continuous coding and wherein each carrier is operable to read a current location from the coding. Thus each carrier can update its position information for progress checking during movement operations.

In some embodiments, each trolley is operable to move along the transit route network at a speed set by the central control. Thus the central control can take charge of speed rates achieved by the carriers within the system. In some arrangements, the speed can be up to at least 2.5ms⁻¹. Thus very rapid carrier movement can be achieved.

Further aspects and embodiments will be apparent from the following detailed description.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Specific embodiments will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic view of a baggage handling system;

Figure 2 is a schematic view of a power trolley system carrier;

Figure 3 is a schematic view of a distributed baggage handling system;

Figure 4 is a schematic view of a power trolley system;

Figure 5 is a schematic view of a carrier controller;

Figure 6 is a schematic view of a carrier and rail; and

Figure 7 is a schematic view of a carrier controller.

While the invention is susceptible to various modifications and alternative forms, specific embodiments are shown by way of example in the drawings and are herein described in detail. It should be understood, however, that drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.
DETAILED DESCRIPTION

Examples of a power trolley system in the context of an airport baggage handling environment will now be described. The skilled reader will appreciate that the same techniques and systems can be employed outside the context of baggage handling and outside the context of airports.

Referring to Figure 1, a complete integrated baggage handling facility 3 using a power trolley system for moving baggage loaded into containers is shown. A baggage handling facility of this type may typically be installed at an airport terminal. The individual containers carried by the power trolley system may be so-called unit loading devices (ULDs) which are conventionally used at airports for carriage of baggage to and from aircraft. The skilled reader will appreciate that a number of different sizes and shapes of ULDs exist and are used in combination with different types and classes of aircraft. It is not important in the context of the present example what form of ULD is used, indeed a container other than a ULD could be used without compromising the operation of the systems of the present example.

Many airlines and security authorities place restrictions on the amount of baggage that a passenger can carry into the passenger cabin of an aircraft. All other baggage is then checked in for carriage in the aircraft hold. Such so called "checked baggage" is typically taken from the passenger when the passenger registers for a flight or flights and is then transported by systems and staff at the airport to the hold of the aircraft on which the owning passenger is to travel.

In the present example, a number of build cells 1 receive checked baggage and forward that baggage via loading load station feeds 16 for loading into containers at load stations 17. The operation of the queues and load stations is not important in the context of this disclosure and so no further discussion thereof is presented herein. The skilled reader with a particular interest in airport specific activities for baggage loading can refer to GB08021 19.8 mentioned above. The skilled reader will appreciate that in fact any viable method for loading baggage into the containers 18 may be used in the context of the present examples.

In Figure 1, it can be seen that a plurality of departures build cells 1 are arranged adjacent to one another. In the present example, there are in fact a total of eighteen build cells distributed between two banks of build cells, one on either side of the baggage handling facility 3. Each bank of build cells 1 has outgoing baggage supplied thereto by a baggage conveyor 46. In the present example, the baggage conveyors 46 receive baggage from passenger check-in desks elsewhere in the terminal building.
As briefly mentioned above, baggage in individual queues of the build cells 1 is loaded into containers 18 carried within a power trolley system 20. The power trolley system 20 links the build cells 1 with container offloading stations 24. In the present example, the container offloading facilities 24 are located with a dedicated tug and dolly loading zone 42, thus providing that all tug and dolly traffic associated with departing baggage is confined to a limited area of the baggage facility.

For the sake of clarity in explanation, the figures show only a single level system. However, the power trolley system can operate on multiple levels. This can increase the efficiency of routing between given locations. This can also allow different build stations to be on different levels, and/or allow different unload stations to be on different levels, and/or can allow build stations and unload stations to be on different levels. In some examples, it may be convenient to have all build stations on a lowest level, and all unload stations on a higher level above the build stations. This has advantages of minimising the horizontal space used by the baggage handling system and of lifting unloading baggage as high as possible using the power trolley system still packed in containers, before unloading the containers for additional raising in height to a baggage reclaim station in a passenger-accessible part of the terminal.

Further, the power trolley system 20 also integrates with an arrivals facility. A number of tug and dolly unloading zones 44 are provided for unloading of containers of arriving luggage. These containers are transferred into the powered trolley system by the container upload stations 30. The containers of arriving baggage then move either for unloading or for holding for onward transfer. Containers for unloading are carried to the unloading positions 36. Here, the containers are unloaded onto an arrivals baggage conveyor 38. The unloaded baggage then travels to a baggage reclaim facility elsewhere in the terminal via the carriage equipment 40. Containers for onward transfer are carried into the departures section of the powered trolley system, and may be held in a waiting area 26 until the onward travel aircraft is ready for loading. In some examples, the upload stations 30 may be co-located with and/or interchangeably functional as offload stations 24.

Also provided in the present example is a holding area 48 for storage of empty containers 18 between uses. The holding area 48 of the present example includes one or more container on/offload stations 50 to enable containers to be entered into and removed from the system without taking up capacity at the arrivals and/or departures loading stations. Containers may be stored in the holding area for a number of reasons, the most likely being that they are simply not required at a given time. It should be considered that many containers are the property of the airline rather than the airport, as each aircraft model/design may be compatible with
different numbers of slightly different shaped containers. The provision of the holding area 48 for currently unused containers also provides for all containers at an airport to be either en-route to or from an aircraft or within the baggage handling system, there being no need or opportunity for spare containers to be left around in the apron region of the terminal.

Thus it can be seen that a single integrated baggage handling system can handle baggage for arrivals, departures and transfers with a minimum exposure of personnel to hazardous vehicle loading and movement areas, and with great flexibility for handling of early baggage and for handling of multiple flights per container loading station. Such a system thus allows for improved efficiency of baggage handling, with improved efficiency of personnel utilisation and improved health and safety circumstances for personnel.

For completeness, Figure 2 shows an example of a container 18 received within a carriage 60 of the power trolley system 20. The means by which the container 18 is received into the power trolley system can be varied and may include one or more of support on a platform, support within a cage or frame, support on bars or beams, support by support members operable to interact with lifting surfaces or members of the container 18, or magnetic support. The power for motion and the motion control for the carrier 60 within the power trolley system 20 is provided by contact between a unit 61 of the carrier and contacts on the rail(s) 62 of the power trolley system 20.

Figure 3 shows an alternative arrangement for a baggage handling system, where there is a requirement for a large travel distance between the build cells 1 at which the containers 18 are loaded with baggage and the container offload stations 24 where the containers are removed from the power trolley system for loading into aircraft. In the present example, the offload stations 24 are for offloading of containers 18 onto a standard airport tug and dolly arrangement, but other offload arrangements such as direct offloading to an aircraft loading lift could be implemented.

In the example of Figure 3, a main terminal building 70 containing passenger facing facilities of baggage check-in and baggage reclaim also includes the build cells 1 fed by feeds conveyor 46 as well as the baggage offload stations 36 for baggage to be removed to a baggage offload conveyor 38 and to be carried to baggage reclaim facilities via carriage equipment 40. However, not all of the airport terminal boarding gates are located within the main terminal building 70. A number of satellite terminals or piers 72 and 74 are provided to handle departing and arriving flights for which baggage check-in and reclaim is handled at the main terminal building 70. The satellite terminals or piers 72 and 74 can be linked to the main terminal building 70.
via conduits 71 and 73. The conduits may be at ground level, held above ground
level or may be underground. In the present example, the power trolley system 20
extends to the satellite terminals 72 and 74 via the conduits 71 and 73. Thus offload
stations 24 and associated transfer areas 42 and upload stations 30 with associated
transfer areas 44 are provided at satellite terminals or piers 42 and 44.

If one considers the example where the conduits 71 and 73 are either high above
ground level such that aircraft can pass underneath, or are underground such that
aircraft can pass over the top, it is likely that there will be a need for aircraft to be
able to pass between the buildings 70, 72 and 73 and to park in standard aircraft
stands against those buildings. This could lead to the conduits being long, for
example many tens or a few hundreds of metres.

Considering now a conventional "off the shelf" power trolley system, such systems
conventionally move at a maximum speed to up to 1ms⁻¹. Such conventional
systems typically employ a system whereby a number of bussbars are located along
a rail of the power trolley system to provide power and control signalling to a
controller of each carriage within the power trolley system. Such an arrangement
leads to the speed limitation of 1ms⁻¹ as the circuitry cannot provide enough power or
fast enough data transfer to allow the controller to achieve higher speeds. Where a
power trolley system needs to move a large distance between operational or holding
areas (such as a load station, unload station, offload station or onload station) such a
limited speed can become a significant factor in limiting the overall performance of
the system within the power trolley system that provides transportation.

Accordingly, a number of aspects of a high speed power trolley system are now
illustrated in Figures 4 to 7. The systems of the present examples can have trolley
speeds of up to at least 2.5ms⁻¹.

Figure 4 shows schematically a part of a power trolley system 20 including a rail 62
along which a number of carriers 60 can move and a central control 80 arranged to
supervise and/or control the movement of the carriers 60 around the system. As
illustrated schematically by dashed lines 79, the central control 80 is able to
communicate in some manner with the carriers 60 to carry out this supervision and/or
control. In one example, a single central control 80 is provided to supervise and/or
control the whole of a power trolley system. In another example, a number of central
controls 80 can be provided, each operable to supervise and/or control a defined art
of the power trolley system 20.

A carrier 60 for a high speed power trolley system is shown in Figure 5. The carrier
60 has a motor 81 for providing motion drive to move the carrier 60 through the
power trolley system 20. The motor 8.1 is controlled by a carrier controller 8.2 which receives a number of inputs to enable it to provide motor control signals.

The carrier controller 8.2 interfaces with a communications antenna 83 for communication between the individual carrier and a central control 80. In the present example, the antenna is operable to communicate using a conventional data communications protocol such as any protocol that can be used on a TCP/IP data network. The antenna may therefore be configured to operate using a wireless data transmission system such as IEEE 802.11a, 802.11b, 802.11g or 802.11n standards (commonly grouped together under the generic heading "wi-fi").

In one example, the communications antenna 83 is an antenna operable to interface with a leaky coax cable which is located along a rail of the power trolley system. Leaky coax based systems are suitable for communications with mobile devices moving along defined lines and offer a reliable radio connection even in areas where standard fixed location antenna technology cannot be reliably or economically deployed. In this example, the leaky cable along the power trolley system rail acts as a local antenna for the central control 80 serving the length of the rail. The cable can be an RCoax cable and the antenna for the carrier can be a compatible antenna such as the Siemens ANT795-4MR, ANT795-6MR, ANT793-8DR or ANT792-8DR although other parts from the same or different manufacturers could also be used.

In another example, the leaky coax cable can be omitted and a number of wireless data antennas or access points with connection back to the central control 80 can be provided in the vicinity of the power trolley system 20 to communicate with the power trolley system control.

In all of these examples, communication between the carrier controller 8.2 and a central power trolley system control can be carried out using common network communication protocols such as TCP/IP to enable easy and reliable unique addressing of communications to particular ones of the carriers within the overall system. The network communication can be arranged to operate as an Ethernet network.

The carrier controller also interfaces with a position reader 84 which is operable to provide a signal indicating the unique position of the carrier 60 within the power trolley system 20. This enables the carrier controller 8.2 to know at any time the location of the carrier 60 within the power trolley system 20, which information can be used by either or both of the carrier controller 8.2 or a central power trolley system control to steer or direct the carrier 60 through the power trolley system 20.
In the present example, the position reader 84 is a barcode reader arranged to read a barcode allocated along a rail 61 of the power trolley system 20. In an alternative example, the position reader could be an RFID reader operable to read location information from a number of RFID tags located along the power trolley system.

An example of the implementation of a leaky coax and barcode system is shown in Figure 6. In this Figure there is illustrated a rail 62 having therealong an leaky coax cable 90 and a barcode 91. The antenna 83 of the carrier 60 is operable to communicate with the central control 80 via the leaky coax cable 90. The position reader 84 of the carrier 60 is operable to read a unique position within the power trolley system 20 from the barcode 91. In such an example, and with reference to Figure 4, the communication between the central control 80 and the carriers 60 is provided by a wired or wireless link from the central control 80 to the leaky coax cable 90 and by the leaky coax cable 90 itself. The link from the central control 80 to the leaky coax cable 90 could be provided by an Ethernet cable from the central control 80 to an access point, which access point passes the signals onto the leaky coax cable 90.

Returning to Figure 5, the carrier controller can also interface with a distance detector 85 for determining the distance between the carrier 60 and any preceding carrier 60 within the power trolley system 20. In one example, the distance detector can be an optical detector. In another example, the distance detector can be an ultrasound detector.

The carrier controller 82 can also interface with a stop 86. This can provide for manual override of the carrier controller 82 and central control 80 at any time by a human operator. The stop 86 may include a sequence stop button located on the carrier.

Thus an overview of the carrier and control systems for providing a high speed power trolley system has been described.

With reference to Figure 7, a more detailed description of the operation of the carrier controller 82 will now be presented. Within the carrier controller 82, a CPU 101 is provided. The CPU 101 may be a general purpose processor or may be some form of application specific integrated circuit. In some examples a microprocessor, microcontroller, programmable logic controller or ASIC may be used. The CPU 101 is operable to monitor and control all aspects of the operation of the carrier 60 under the instructions/supervision of a central control 80 of the power trolley system 20. The CPU 101 controls the movement of the carrier 60 within a set of operational bounds provided by the central control 80 using the information from the position.
reader and distance detector and subject to override or operational bound replacement from the stop or the communications antenna. The CPU 101 can be operable to communicate with other system elements using network communication protocols such as TCP/IP for use on a network such as an Ethernet network. This can be provided as a direct communication capability of the CPU 101 or a network interface (not shown) can be provided.

The CPU 101 can receive input from the distance detector 85 and the stop 86. The CPU 101 can control the movement of the carrier 60 by means of a drive 102 which provides drive signals to the motor 81. In one example, the drive can be a regenerative drive which enables electricity generated by the motor when braking to be provided to the supply net. The CPU 101 can also receive position information from the position reader 84 via a suitable interface 103. The interface may be, for example, a serial interface such as an RS232 interface. The CPU 101 can communicate with the central control 80 via a client module 104 that provides an interface to the communications antenna 83. The client module provides for conversion between wired Ethernet data signals and the high frequency wireless signals.

In the present example, the functionality of the controller 82 has been described with reference to a number of separate modules or units, the functionality of these modules/units can however be combined within fewer modules/units or spread over additional modules/units.

Thus it will be understood how the carrier controller 82 is able to control the movement of the carrier 60 under the overall control of the central control 80.

In the present example, the carrier control 82 controls movement of the carrier 60 using instructions or bounds set by the central control 80. To achieve this, each carrier control 82 can send to the central control 80 data for use by the central control 80 in supervising all of the carriers 60 for which it has responsibility. Also, the central control 80 can send to the carrier controller 82 of each carrier 60 instructions or operational parameters describing the required behaviour of the carrier.

In one example, the data transferred from the master controller 80 to the carrier controller 82 includes a next stop position defining where the carrier must next stop, an empty/full descriptor to indicate whether the carrier is presently full or empty, a container type descriptor to indicate a container type currently carried by the carrier, a target descriptor to indicate a destination for the carrier, and a speed descriptor to indicate a motion speed that the carrier should use. The empty/full descriptor and the current container type descriptor are optional data which enables different speeds
to be used for empty and full carriers. Also, such data in the carrier provides a backup for the central control in case the central control were to lose this information.

In this example, the data transmitted from the carrier controller 82 of each carrier 60 to the central control 80 can include a target descriptor to enable a switch or junction of the power trolley system to be set correctly to cause the carrier to follow the most appropriate route to the target, and a current position descriptor for the carrier's location within the power trolley system.

Using the arrangements described above, a power trolley system can be implemented which provides a high level of controllability and high carrier speed.

Use of the wireless communication between the central control and each carrier controller enables a large data bandwidth such that a large amount of data can be carried, leading to arrangements where a high granularity of control is available. From each central control 80 it is possible to examine the software limits on the carrier drive unit and if necessary to adapt it. The control that is enabled by this approach enables different carriers to be caused to use different transit speeds at different times for movement around the power trolley system. Thus, high speeds can be used for long transit sections (such as for journeys through the conduits 71 and 73 illustrated in Figure 3) and lower speeds can be used where the presence of junctions, bends, loading stations, unloading stations, lifts, human operators or other factors prevents the use of a high speed. Thus it is clear that each carrier's drive can be remotely controlled by the download of parameters from the central control 80.

By knowing the unique position of each carrier within the power trolley system, the granularity of control can be further improved, and flexibility of the system to adapt to developing operating conditions is provided.

Using the position information from each carrier along with the target for each carrier, the central control can establish a routing plan for all carriers within the power trolley system. As the paths for different carriers are likely to overlap or intersect, the routing plan defines for each carrier a virtual wall (next stop position) for each carrier. Each carrier's next stop position can then be sent to the respective carrier controller. Based on knowledge of the next stop position, the carrier can drive itself to that next stop position at a speed indicated by the speed descriptor, all the while double-checking that it can continue to move at the indicated speed by use of the distance detector to ensure that it does not get too close to a previous carrier. When the carrier approaches the next stop position, it will control itself to slow and stop at the defined next stop position.
The virtual walls defined in the routing plan can be updated on an ongoing basis. As such, by careful control of carrier routing and speeds, all carriers can be routed to their respective target with a minimum amount of waiting and stopping for maximum efficiency in operation. By avoiding unnecessary stopping and starting of carriers, the energy consumed by the power trolley system can be reduced as the energy required to maintain existing motion is, in most cases, lower than the power required to increase speed of motion. Also, by use of a regenerating drive as mentioned above, some energy can be recovered under braking so as to further reduce overall power supply requirements.

If, during the movement of a carrier to a next stop position, it approaches a path junction within the power trolley system, the central control ensures that a path switch is set to route the carrier along the correct path within the power trolley system. In one example, the carrier simply identifies itself and provides its location to the central control. Using this information, the control can look up either or both of the target and next stop position for the carrier and set the switch accordingly. In another example, the carrier provides its location and either or both of its next stop position and its target to the central control. Using this information the central control can set the switch accordingly.

By communicating the approaching presence of a path junction well in advance, the system of the present example can control the path switch associated with the junction to be aligned in accordance with the routing requirements for the carrier before the carrier arrives at the junction. Thereby unnecessary braking, stopping and waiting can be avoided.

In the present description, the word baggage means generally; bags, suitcases, luggage and packages being items of baggage belonging to passengers travelling by a vehicle in circumstances where the baggage is separated from the passenger during a voyage. Typically this occurs in travel by aircraft, but the present inventions are also applicable to analogous situations where baggage is separated from a passenger during travel. Examples may include rail travel, sea travel and space travel.

Although the present invention have been described in the context of baggage handling of checked baggage for passengers, the handling systems proposed by the present invention are equally applicable to handling of other forms of packages for carriage. The skilled reader will appreciate that a system of the type described could be used in any circumstance where articles need to be transferred from an inflow to a transportation device and/or received from a transportation device to an article outflow. The skilled reader will further appreciate that the present invention can be
deployed in any power trolley system, not only one deployed at an airport or other baggage facility.

Although the invention has been described with reference to the above specific examples, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.
CLAIMS

1. A power trolley system carrier control unit comprising:
   a processor operable to:
       receive via a wireless channel position data describing a present
       position of the carrier within a power trolley system;
       receive via the wireless channel target position data describing a target
       position for the carrier within the power trolley system;
       receive via the wireless channel distance data describing a relative
       position of a further carrier within the power trolley system; and
       provide movement control data to a drive unit to cause the carrier to
       move from the present position to the target position.

2. The unit of claim 1, further comprising a position detector operable to
detect the present position and to provide the position data to the processor.

3. The unit of claim 2, wherein the position detector is operable to detect
the present position by reading a location code provided along the power
brolley system.

4. The unit of claim 3, wherein the location code is a barcode provided
along a rail or track of the power trolley system.

5. The unit of claim 3, wherein the location code is provided by a plurality
of RFID tags along the power trolley system.

6. The unit of any preceding claim, further comprising a distance detector
operable to detect a distance to a further carrier and to provide the distance
data to the processor.

7. The unit of claim 6, wherein the distance detector is operable to detect a
distance to a closest further carrier in a current movement direction of the
carrier.

8. The unit of claim 6 or 7, wherein the distance detector is an optical
detector operable to detect a distance by means of an observed image size.
9. The unit of claim 6 or 7, wherein the distance detector is an optical or ultrasound detector operable to detect a distance by means of a signal time of flight analysis.

10. The unit of any preceding claim, further comprising an antenna operable to receive via the wireless channel data describing the target position from an external control and to provide the target position data to the processor.

11. The unit of claim 10, wherein the antenna is further operable to transmit the present position data to an external control via the wireless channel.

12. The unit of claim 10 or 11, wherein the antenna is operable to transmit signals to and receive signals via the wireless channel from a signal carrier along the power trolley system.

13. The unit of claim 12, wherein the signal carrier comprises a plurality of access points disposed around the power trolley system.

14. The unit of claim 12, wherein the signal carrier comprises a leaky coax cable along a track or rail of the power trolley system.

15. The unit of any of claims 10 to 14, wherein the antenna is further operable to receive data describing one or more of a movement speed, a load status and a load type from a central control.

16. The unit of any preceding claim, further comprising a drive unit operable to receive the movement control data from the processor and to control a drive motor in accordance therewith.

17. The unit of claim 16, wherein the drive unit is operable to control the drive motor to achieve a movement speed in accordance with speed instructions received by the unit from an external control.

18. The unit of claim 17, wherein the movement speed is up to at least 2.5ms⁻¹.
19. The unit of claim 17 or 18, wherein the movement speed defined in the speed instructions is dependent upon a load status of the carrier.

20. A power trolley system carrier comprising the control unit of any preceding claim.

21. The carrier of claim 20, further comprising a drive motor.

22. A power trolley system comprising a plurality of carriers according to claim 20 or 21.

23. The system of claim 22 further comprising a control operable to control the movement of the plurality of carriers.

24. A method of controlling carriers within a power trolley system, the method comprising:
   receiving at a carrier control processor via a wireless channel position data describing a present position of the carrier within a power trolley system;
   receiving at the carrier control processor via the wireless channel target position data describing a target position for the carrier within the power trolley system;
   receiving at the carrier control processor via the wireless channel distance data describing a relative position of a further carrier within the power trolley system; and
   providing movement control data from the carrier control processor to a drive unit to cause the carrier to move from the present position to the target position.

25. The method of claim 24, further comprising:
   reading, by a position detector, a location code provided along the power trolley system;
   and transmitting from the position detector via the wireless channel the position information.

26. The method of claim 25, wherein the reading a location code comprises location code reading a barcode provided along a rail or track of the power trolley system.
27. The method of claim 24, 25 or 26, further comprising:
detecting, by a distance detector, a distance to a further carrier; and
providing the distance data to the carrier control processor.

28. The method of any of claims 24 to 27, wherein the receiving via the wireless channel comprises receiving via an antenna operable to receive via the wireless channel data describing the target position from an external control and to provide the target position data to the processor.

29. The method of claim 28, further comprising transmitting the present position data to an external control via the wireless channel via the antenna.

30. The method of claim 28 or 29, wherein the receiving and/or transmitting via the antenna comprises receiving signals from and transmitting signals to the wireless channel from a signal carrier along the power trolley system.

31. The method of claim 30, wherein the signal carrier comprises a leaky coax cable along a track or rail of the power trolley system.

32. The method of any of claims 28 to 31, further comprising receiving via the antenna data describing one or more of a movement speed, a load status and a load type from a central control.

33. The method of any of claims 24 to 32, further comprising:
receiving the movement control data from the processor at a drive unit;
and
controlling a drive motor in accordance therewith.

34. The method of claim 33, further comprising:
receiving at the carrier control unit from an external control speed instructions;
controlling by the drive unit the drive motor to achieve a movement speed in accordance with the speed instructions.

35. A power trolley system comprising:
a central control operable to, for each of a plurality of carriers, transmit data describing current position, target position and next carrier distance to the trolley via a channel including a wireless channel segment;

a transit route network operable to carry thereon a plurality of carriers and having co-located therewith a leaky coax cable to provide signal carriage for a non-wireless segment of the channel and to provide signal radiation for the wireless segment of the channel;

a plurality of carriers, each operable to receive via the wireless channel segment the data describing current position, target position and next trolley distance and to move along the transit route network to the target position.

36. The system of claim 35, wherein the transit route network also has co-located therewith a carrier-readable continuous coding and wherein each carrier is operable to read a current location from the coding.

37. The system of claim 35 or 36, wherein each carrier is operable to move along the transit route network at a speed set by the central control.

38. The system of claim 37, wherein the speed is up to 2.5ms⁻¹.

39. A power trolley system substantially as hereinbefore described.

40. A power trolley system carrier control unit substantially as hereinbefore described.

41. A power trolley system carrier substantially as hereinbefore described.

42. A power trolley system central control substantially as hereinbefore described.

43. A method of operating a power trolley system substantially as hereinbefore described.
**INTERNATIONAL SEARCH REPORT**

**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

| Inv. | B64F1/36 | B65G1/04 | ADD. |

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

| B64F | B65G |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

|   | col umn 2, line 68 - col umn 3, line 5 | |
|   | col umn 2, line 63 - col umn 4, line 2 | |
|   | col umn 4, lines 58-66 | |
|   | col umn 9, lines 20-34 | |
|   | col umn 6, line 56 - col umn 10, line 27 | |
|   | col umn 10, lines 60-63 | |
|   | col umn 11, lines 6-14 | |
|   | col umn 12, lines 44-59 | |
|   | col umn 16, lines 46-68; figures 1,3,4, 10-13 | |

| A | WO 90/08086 Al (MAGNET MOTOR GMBH [DE]) 26 July 1990 (1990-07-26) | 1,24,35 |
|   | page 1, paragraph 2 - page 2, paragraph 3 | |
|   | page 3, paragraph 3 | |
|   | page 12, paragraph 1-2; figures 1,2 | |

* Special categories of cited documents:

- **A** document defining the general state of the art which is not considered to be of particular relevance
- **E** earlier document but published on or after the international filing date
- **L** document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- **O** document referring to an oral disclosure, use, exhibition or other means
- **P** document published prior to the international filing date but later than the priority date claimed

- **T** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- **Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- **Z** document member of the same patent family

**Date of the actual completion of the international search**

1 February 2012

**Date of mailing of the international search report**

09/02/2012

**Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016**

**Authorized officer**

Busto, Mario
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>column 1, lines 41-55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>column 4, lines 1-6,24-28,50-57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>column 6, lines 42-46</td>
<td></td>
</tr>
</tbody>
</table>

Form PCT/ISA210 (continuation of second sheet) (April 2009)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 5228820 A</td>
<td>20-07-1993</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 3900511 AI</td>
<td>12-07-1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 9008086 AI</td>
<td>26-07-1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 722961 B2</td>
<td>17-08-2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 3694497 A</td>
<td>02-02-1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BR 9706535 A</td>
<td>20-07-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2228000 AI</td>
<td>15-01-1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1197438 A</td>
<td>28-10-1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 19626966 A</td>
<td>08-01-1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0961743 AI</td>
<td>08-12-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES 2197998 T3</td>
<td>16-01-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HK 1016951 AI</td>
<td>05-09-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HK 1023975 AI</td>
<td>18-07-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP H11513962 A</td>
<td>30-11-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6213025 B1</td>
<td>10-04-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 9801377 AI</td>
<td>15-01-1998</td>
</tr>
</tbody>
</table>