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(71) Applicant: **RIDEUP MOBILITY INC.** [CA/CA]; 1225,
 ch. des Pères, Magog, Quebec J1X 5R9 (CA).

(72) Inventors: **DEGRACE, Christian**; 1225, ch. des Pères,
 Magog, Quebec J1X 5R9 (CA). **MOLINER, Michael**;
 201, Chemin Bellevue, Eastman, Québec J0E 1P0 (CA).

(74) Agents: **BROUILLETTE, Robert** et al.; Brouillette &
 Associés/Partners, 377 de la Commune West, Montréal,
 Québec H2Y 2E2 (CA).

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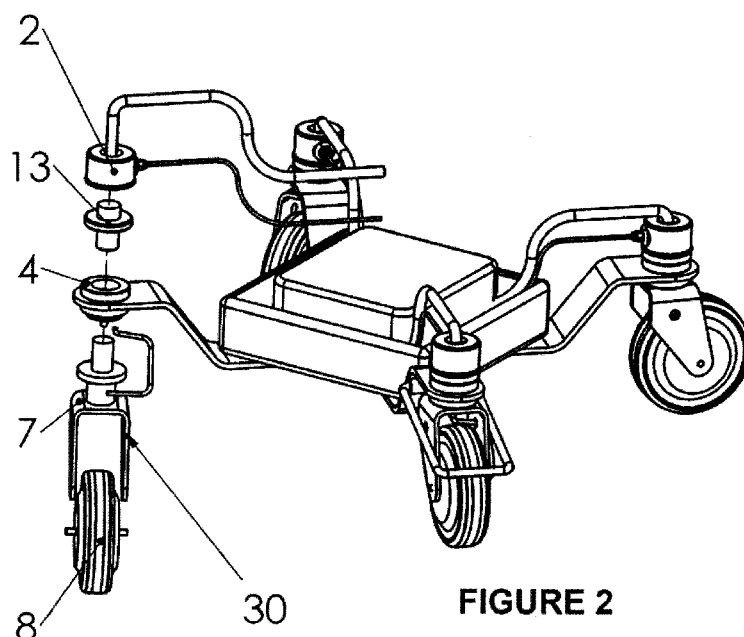
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(54) Title: MOBILITY TRANSPORT SYSTEM AND METHOD HAVING A PLURALITY OF MOTORIZED WHEEL ASSEMBLIES

**FIGURE 2**

(57) Abstract: A motorised wheel or propulsion mechanisms grouping operating geometry that uses of various sensors to move in any desired direction. When a toggle direction is chosen, a controller determines the wheel to be restrained and/or to be moved in order to rotate the wheel in different directions to allow the movement of the mobility transport system in a specific direction. The power management (restrain and/or movement) is automatically synchronized between the wheels to ensure a proper path, either straight, curved and/or lateral and to provide the proper amount of traction under various surface conditions. Rolling resistance, wheel speed, and surfaces are other factors that may be controlled and added to the vector calculation in order to adjust the power to all motorised wheels so the desired direction of travel can be maintained.



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Title of the Invention

MOBILITY TRANSPORT SYSTEM AND METHOD HAVING A PLURALITY OF MOTORIZED WHEEL ASSEMBLIES

Cross-Reference to Related Applications

[001] The present patent application claims the benefits of priority of U.S. Provisional Patent Application No. 61/645,402, entitled "Mobility Transport Platform and Method Having a Plurality of Motorized Castor Wheels", and filed at the U.S. Patent and Trademark Office on May 10, 2012, the content of which is incorporated herein by reference.

Field of the Invention

[002] The present invention generally relates to transport having a plurality of motorised wheel assemblies that can be used in the general transport of people, objects, materials or any combinations of these elements.

Background of the Invention

[003] The use of transport platforms, including both powered and manually driven transport platforms, has been well known for many years. As their name implies, transport platforms have been used to optimize the transportation of the all types of goods, objects, material, people or any combination thereof. Typically, a manually operated transport platform, usually referred as carts, comprises more than one wheel attached under a spectrum of platforms type allowing the completion of different tasks. Such transport platform may be moved by a user by pushing or pulling such manually operated transport platforms.

[004] On the other hand, powered transport platforms usually comprise a fairly complex drive system for operating the multiple wheels or single wheel of such platform. Generally, a hand controller or an independent controller is used to control or operate such drive system. As a result, the price for manufacturing, and as a consequence for selling, a powered transport platform is substantially higher than the price required for manufacturing a manually operated transport platform.

[005] Furthermore, another problem related to current motorized transport platform is that such platform may not move laterally. In fact, lateral movement allows a higher degree of comfort and an improved efficiency for any given operation of the platform. As an example, it is impossible for a typical motorized transport platform to

move laterally along or adjacent to a work surface if the wheels are not parallel to the work surface.

[006] Accordingly, there is a need for a motorized transport system having a plurality of motorised wheel assemblies to providing an easy lateral movement without realignment of the motorized transport platform to the desired direction. Such lateral movement would allow an operator to quickly change the direction a transport device in a perpendicularly or otherwise direction pertaining to the initial direction.

Summary

[007] The present invention generally provides a motorized transport system having a plurality of motorised wheel assemblies allowing total directional travel. Such motorized system comprises a base and/or device support structure wherein such base and/or device support comprises one or more motorised wheel assemblies, each motorized wheel assembly comprising a support structure, wherein the caster wheel support structure contains a motorized hub wheel. The caster wheel support structure may allow a wheel to freely rotate around an axis that is laterally offset in relation with the pivotal axis of the caster assembly. Each of the caster wheel assembly structure is monitored by a rotary encoder that continually reads the position of the caster assembly in relation to the base structure. Each caster assembly is connected to the base support structure wherein such base structure may allow the attachment or the mounting of different apparatus providing a mean to many different applications such as, but not limited to, a standard motorized cart, a device, a platform, a small vehicle, a wheel chair, or a personal transport for a person.

[008] One of the objects of the present invention is to provide an apparatus for any person requiring pivoting around a center point and/or changing direction without modifying the directional alignment of the platform. Thus, it shall provide a more usable motorized transport platform to a user and allows a user to continue working on a specific task as the platform is repositioned. The independent motor hubs and caster type mount allows the motorized transport device having a plurality of motorised wheel assemblies to access smaller areas, which may be hardly accessible using conventional devices. The motorized transport platform provides an enhanced directional freedom to the user. Also, the general geometry of the motorized transport platform allows better and more interactive movements.

[009] To realize the objects of the present invention, the motorized transport platform comprises motorized wheel, typically casters, which may freely swivel. To control the direction of the motorized transport platform, a wheel assembly comprises an optical encoder that reads the exact position and direction of a caster in relation to the plurality of motorised wheel assemblies. The information from all wheel assemblies is then relayed to a central control unit which processes through a specialized algorithm the said received information and the input directional information from the user. Then, the control unit sends directional information and power impulses to each wheel assembly. Based on the received information, the wheel assembly will either restrains the rotation of the caster wheel, by locking or slowing one of the motorized wheel of an assembly or by preventing the wheel to move, or will power the wheel to rotate in the direction, thus allowing the platform to be moved in the user's desired direction.

[0010] Such movement is created by sending multiple information impulses, typically at a specific frequency to each wheel to either rotate or restrain each wheel as they begin to turn on their swivel axis. With all wheels freely swivelling, the information from all the rotary encoders is inputted into the central control unit. After processing the information, the central control unit communicates a directive to one or more specific wheels to rotate or to have the rotation of the wheels restrained in order to allow the platform to be lead or directed in the desired direction. At this point in time, the status of one or more specific wheels is changed to "primary wheel" and the status of all the other wheels is changed to "slave". The one or more primary wheels will be directed in the user's desired direction. The movement and direction are inputted to the controller which calculates a new directional vector immediately having proportional power intensity. Concurrently another wheel may be designated a primary role. In this case, and the rotation of one or more other wheels will be restrained or stopped to create new different pivot points. As this information loop or retroaction will be completed numerous times per second, the platform will be smoothly moved and directed in the desired direction, thus, allowing the motorized transport system to be moved in any direction or to be rotated on a single pivot point.

[0011] The assembly position is typically monitored by an optical or mechanical rotation device that continually defines the precise position of the caster relative to other casters and other wheel assemblies and direction desired though the central

control unit/toggle. This active caster wheel control feature automatically sends multiple inputs from all sensors, then information to the control unit will determine the traction direction power regulation and power restraint to the hub motors thereby limiting the increase of excessive acceleration, while wheel caster free rotation turn
5 until all wheels are directionally positioned in the desired vector direction of travel as determined by the toggle position and individual wheel speeds. As the direction is determined, the inputs to the control unit from the motors and sensors continually monitor the direction. Rolling resistance, wheel speed, and surfaces can be added to the vector calculation adjusting the power to all motorised wheels so the desired
10 direction of travel can be maintained.

[0012] A further object to the present invention is to provide a motorized transport system that is lightweight, affordable, and that enables the transportation of people or goods in any direction. Another object of the present invention shall be to operate or move the motorised transport system in any type of terrain or environment.

15 [0013] The motorised transport system of the present invention enables the user to transport and manoeuvre through a wide variety of domestic, urban, industrial environments

[0014] The motorized transport system is suitable for all types of goods and people transportation and any combination thereof. Also, the motorized transport system may
20 accommodate a range of task oriented utilities.

[0015] The locking of motorized wheels creates pivot points and allows the wheel to turn, thus stabilizing the motorized transport platform when proceeding to loading and/or unloading tasks.

[0016] In a preferred embodiment, the motorized transport system position relative to
25 the ground is dynamically changed using the motorized wheels according to the movement of the joystick or control device. To control the power to the motorized wheels, a signal is communicated from the control device to each wheel or to each wheel controller device. Such signal may be sent at a specified continuous frequency or may be sent as an intermittent impulse. A second signal must be sent from the
30 wheel assembly to the central controller to communicate the wheel rotation status. Thus, the two signals create a bi-directional or two-way communication between the wheels or wheel assembly and the central controller or control device. Furthermore, a

wheel requires electric current in order to power the motorization mechanism of the wheel. As a result, the two-way communication between both the central controller and the wheels allows smooth directional transition by stopping or holding a wheel or by powering a wheel, either in reverse or forward direction.

5 [0017] One of the objects of the present invention is to provide a motorised transport system comprising a central control unit, at least two swivel wheel assemblies, which assembly comprising at least one pivotally mounted wheel comprising an internal motor and acting as a free wheel or as a drive wheel, a device allowing the reading of position and direction information of the at least one wheel, a data communication
10 method to relay the read information to the central control unit, at least one directional controller wherein the control unit is configured to calculate the direction of rotation of each wheel according to the at least one directional controller.

[0018] In another embodiment, the motorized transport system position relative to the ground may be automatically controlled by the central controller or may be controlled
15 by a remotely positioned controller or user.

[0019] A further object of the present invention is to provide a method for moving a motorised transport system comprising a central control unit, a plurality of swivel wheel assemblies, wherein the plurality of swivel wheel assemblies comprise at least one mounted wheel comprising an internal motor, a device allowing the reading of
20 position and direction information of the at least one wheel and a data communication method to relay the read information to the central control unit, at least one directional controller, wherein the method comprises the step for the least one control directional controller to select a direction, for the control unit to read the current direction and rotation of the plurality of swivel wheel assemblies, for the control unit to calculate
25 the direction of rotation of each wheel according to the selected direction of the at least one control handset, for the control unit to identify at least one wheel to act as a drive wheel among the plurality of wheels according to the selected direction of the at least one control handset and/or for the control unit to communicate a rotation signal the at least one drive wheel.

30 [0020] The features of the present invention which are believed to be novel are set forth with particularity in the appended claims.

Brief Description of the Drawings

[0021] The objects, features and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

5 [0022] Figure 1 is an isometric view of an embodiment of a motorized transport system according to the present invention.

[0023] Figure 2 is an exploded view of a motorized transport system caster assembly having independent wheels assemblies in accordance with the present invention.

10 [0024] Figure 3 is a top view of a motorized transport system attached to a unifying device according to the present invention

[0025] Figure 4 is a perspective view of the motorized transport system according to the present invention embodied as a personal mobility chair to transport people.

15 [0026] Figure 5 is a perspective view of the motorized transport system according to the present invention embodied as a container bin allowing the transport of a plurality of different items.

[0027] Figure 6 is a side view of a caster swivel assembly showing the different axis of the assembly and the possible rotation directions of the wheel.

[0028] Figure 7 is an isometric view of an embodiment of a motorized transport system according to the present invention comprising a slip ring.

20 **Detailed Description**

[0029] A novel motorized transport system will be described hereinafter. Although the invention is described in terms of specific illustrative embodiment(s), it is to be understood that the embodiment(s) described herein are by way of examples only and that the scope of the invention is not intended to be limited by these illustrations.

25 [0030] As illustrated in Figures 1 and 2, the motorized transport system 20 generally comprises at least one swivel wheel assembly 30. Typically, the at least one wheel assembly 30 are attached to a common base or device structure 1. The motorized transport system further comprises at least one swivel wheel attachment plate 3, at least one alimentation cable 5, at least one wheel 8, at least one central control unit 10
30 and at least one directional controller 11, such as, but not limited, to a handset. In the present embodiment, the swivel wheel assembly 30 is attached to the device structure

1. As illustrated in other embodiments presented in Figures 4 and 5, a specific unit or module may be attached to or on the base structure 1 in order to provide different functions, such as but not limited to carrying one or more person in a seat 14 (as illustrated in Figure 4), to transport goods or objects in a container bin 16 (as illustrated in Figure 5) or to move large objects by placing the at least one wheel assembly at specific and key location on the device (not shown).

[0031] Still referring to Figure 1, at least one power supply device, such as batteries, at least one control unit 10 or any other electronic component acting as a controller and being required by the motorized transport system 20, at least one wheel 8 and at least one swivel wheel assembly 30 are mounted on the device structure 1. In the preferred embodiment, a swivel wheel assembly 30 is mounted at position on the device structure 1 allowing the motorized transport system 20 to be moved or rotated using the said at least one swivel wheel assembly. In a preferred embodiment, a swivel wheel assembly 30 is mounted at each corner or each end of the device structure 1. At least one motorized swivel wheel 8 is pivotally mounted within each swivel wheel assembly 30.

[0032] A wheel 8 may be embodied as a swivel wheel caster, a wheel having an inflated tire or a rigid wheel. A wheel 8 may act as a free wheel, such as typical free caster, or a drive wheel. A drive wheel may comprise at least one integrated motors propelling the unit. A drive wheel may comprise an integrated brake for brushed motors or a self braking brushless motor. The motor is pivotally attached to the swivel wheel frame 7 which is free to pivot on an offset pivot as it may be found in any caster wheel configuration. A free wheel usually follows the direction determined by the drive wheels. Additionally, a free wheel may comprise a restraining or locking system in order to slow or stop the rotation of the wheel without having recourse to an integrated motor. In other embodiments, additional free wheels may be mounted to the device structure 1 to the frame to provide better stability or to meet specific user's needs of the motorized transport system 20.

[0033] The at least one alimentation cable 5 typically allows electrical current to power a motorized wheel 8 or any other bi-directionally communication signal required to provide control and determine the position of a motorized wheel 8. It shall be known to the one skilled in the art that any other mean for providing electrical current or relaying or communicating a signal may be used to control a motorized

wheel 8, such as wireless communication. It should be noted that a peripheral computing unit may be mounted to the wheel 8 or to the swivel wheel assembly 30 in order to wirelessly communicate with the central control unit 10.

5 [0034] Now referring to Figure 7, in another embodiment, one or more wheels 8 may comprise a directional locking mechanism 17 or any mechanism limiting the wheel 8 rotation to two directional movements.

[0035] Referring back to Figure 1, the at least one central control unit 10 may be embodied as a computer comprising a processor unit, a memory unit, a storage device and a plurality of IO ports for communicating with the control unit 10. In another
10 embodiment, the central control unit 10 may be replaced by a plurality of control units configured to provide parallel or mesh computing.

[0036] The at least one directional controller 11 allows the operator to control the motorized transport system 20 and may be embodied as a multi-directional control lever or a joystick. In another embodiment, the directional controller 11 may be
15 embodied as wired or wireless computing device such as, but not limited to a smart phone, a tablet, a pocket PC or any other computing device having a processor and allowing the communication with the central control unit 10.

[0037] In a further embodiment, the at least one directional controller 11 may be replaced by a controller automatically calculating the desired position of the
20 motorized transport system. Such controller 11 may be integrated to the central control unit 10 or may be integrated in a remote device or computer wirelessly communicating the position to the central control unit 10 or to the at least one swivel wheel assembly 30.

[0038] In a preferred embodiment, the central control unit 10 is connected or
25 comprises a computing device, such as a microcomputer. A central control unit 10 runs a program, typically in real time. The program reads or receives the current state of the directional controller 11. Based on the current state of the directional controller 11, the program commands or controls the wheel assemblies 30 to direct the motorized transport system 20 in the direction of the directional controller 11. The
30 program starts the propelling motor resulting in feedback from the wheels assembly sensors. The program analyze and calculate in real time the resulting feedback and

corrects or change the power sent to each motor in ways to direct the motorized transport system in the desired direction while maximizing the fluidity of movement.

[0039] Still in another embodiment, the program may be a finite automaton. An automaton comprises different states and transitions. The state is a combination of wheels sensors data feedback and the different forces applied to any of the wheel assemblies 30. The transition is typically a change of direction and/or a velocity caused by the action of an operator on the directional controller 11. During a transition, the program changes the strength applied to a wheel assembly 20 in ways to obtain the desired direction and speed. These forces changes concurrently apply to the wheel assemblies 20, typically taking place in a few milliseconds difference, as a “choreography”. As such, the changes in forces cause the change of direction and desired speed. The program then calculates and actions the optimal choreography of the motorized wheel according to the current state and the desired transition.

[0040] One skilled in the art shall understand that any other program or algorithm allowing the control of the power to the wheel assemblies 20 may be used, such as an expert system or multi-threaded program.

[0041] Now referring to Figure 2, an embodiment of a swivel wheel assembly 30 is shown. In this embodiment, each swivel wheel assembly 30 of the motorized transport system 20 comprises a set of bearings 4 or any other apparatus to pivot around a vertical axis, a slip ring 13, at least one optical encoder 2 and a swivel wheel assembly frame 7. At least one wheel 8 is pivotally mounted within the swivel wheel assembly frame 7. One skilled in the art shall understand that any other embodiment of a swivel wheel assembly 30 may be used to allow the motorized transport system 20 to be moved and rotated.

[0042] Now referring to Figure 6, a wheel is pivotally mounted within axis B of the swivel wheel assembly 30. The axis B is laterally offset to the pivoting axis A of the swivel wheel assembly 30. A wheel 8 is typically pivotally mounted to the swivel wheel assembly frame 7 using a rigid rod or any rotating mechanisms such as bearings which allows the rotation of the wheel as shown by C.

[0043] Now referring back to Figure 2 showing a preferred embodiment, at least one power and communication cable 5 are connected to a slip ring 13. The slip ring 13 allows the electrical current to power a wheel 8 regardless of the position of the wheel

8. As it should be appreciated by the one skilled in the art, a slip ring 13 consists of a method of to electrically connect two members using a rotating assembly. Slip rings 13 are also known as rotary electrical interfaces, rotating electrical connectors, or electrical rotary. A mechanism easing rotating movement 4, such as bearings or bushings is mounted in an aperture of the swivel wheel attachment plate 3 and allows the support the load and facilitates the rotation of a wheel 8.

[0044] At least one rotary encoder 2 is attached or mounted on the swivel wheel assembly 30. Actually, two main types are found on the market: absolute and incremental (relative). The output of an absolute encoder indicates the current position of the shaft, acting as angle transducers. The output of incremental encoders provides information about the motion of the shaft. Typically, such information may be processed in order to determine speed, distance, RPM and position of a wheel 8. It should be noted that the processing of such information may be executed within the rotary encoder 2 or may be processed within a central unit 10 or any peripheral processing unit. The combination of the slip ring 13 and the at least one rotary encoder 2 allows the communication of at least the position, speed and direction information to the central unit 10. Using the positional and rotation information from one or more wheel 8, the motorized transport platform direction may be controlled by processing each wheel 8 information through the central unit 10 and by communicating to each swivel wheel assembly 30 the required speed, position or rotation information in order to control the direction of motorized transport system 20.

[0045] In order to control each wheel 8, the required information may be relayed to each wheel 8 through the use of one or more electrical impulses. Such impulse received by a wheel 8 should direct the directional information, such as direction of rotation, the speed of rotation or a command stopping all rotation. The directional information is inputted to the control unit 10 through the directional controller 11 which is controlled by the user. Then, the central control unit processes the inputted directional information to determine the required rotational or locking movement for each wheel 8 and relays the processed information to each swivel wheel assembly 30. Based on the received processed information, one or more wheel 8 will be rotated and other wheels 8 will be locked. It should be noted that all wheels 8 may be moved at the same time and, in this event, no wheel 8 shall be locked.

[0046] The selection or choice of rotating wheels 8 is determined by the wheel 8 rotation position as indicated by the rotary encoder 2. The direction of rotation of the wheel is determined by the central control unit 10 based on the selected direction of travel by the user. Therefore, direction of one or more wheels 8 may not necessarily align with the direction of travel but rather in the direction allowing the platform 20 to be most likely moved in the user's desired direction. One or more locked wheel 8 provides one or more pivot point enabling the motorized platform to rotate on itself.

[0047] In order to achieve such movement of the motorized transport system 20, the device swivel wheel assembly 7 shall communicate the wheel 8 rotation position to the central control unit 10 at predetermined frequency. The central control unit 10 analyzes and processes the retroaction information from the swivel wheel assembly 7 and from the directional controller 11 to calculate the desired directional and rotational information of the wheels 8. Such retroaction communication may be executed multiple times. The frequency of the data retroaction loop is determined to achieve a smooth directional transition of the platform 20.

[0048] It is important to note that the input information from the user is supplied via multiple different types of wired or wireless devices and is not limited to the illustrated directional controller 11.

[0049] In another embodiment, any weighted mechanism or accelerometers could be mounted on the motorized platform 20 and would allow the calculation of the direction of the actual travel and process such information with the user input or movement on the platform.

[0050] It is to be noted by one skilled in the art that the apparatus and structure according to the present invention do not require symmetrical elements, such as symmetrical base structure 1 or a symmetrical number of wheels 8 on each end. In another embodiment, the base structure 1 may be asymmetrical and may comprised wheels having different sizes.

[0051] In a further embodiment, suspension systems or mechanisms may be added to the platform 20 in order to provide a smoother ride or travel and to allow the motorized platform 20 to better travel on uneven terrain.

[0052] While illustrative and presently preferred embodiment(s) of the invention have been described in detail hereinabove, it is to be understood that the inventive concepts

may be otherwise variously embodied and employed and that the appended claims are intended to be construed to include such variations except insofar as limited by the prior art.

Claims

- 1) A motorised transport system comprising:
 - a) a central control unit
 - 5 b) at least two swivel wheel assemblies, each assembly comprising:
 - i) at least one pivotally mounted wheel comprising an internal motor and acting as a free wheel or as a drive wheel;
 - ii) a device allowing the reading of position and direction information of the at least one wheel;
 - 10 iii) a data communication method to relay the read information to the central control unit;
 - c) at least one directional controller;wherein the control unit is configured to calculate the direction of rotation of each wheel according to the at least one directional controller.
- 15 2) A motorised transport system as described in claim 1, wherein the motorized transport system comprises a device structure and wherein each swivel wheel assembly is mounted to the device structure.
- 3) A motorised transport system as described in either claim 1 or 2, wherein the least one wheel is a caster wheel.
- 20 4) A motorised transport system as described in any of the claims 1 to 3, wherein one or more wheel acting as a free wheel follows the direction determined by the one or more drive wheels.
- 5) A motorised transport system as described in any of the claims 1 to 4, wherein the at least one wheel assembly comprises a restraining system configured to slow or
25 stop the rotation of the wheel without having recourse to an internal motor
- 6) A motorised transport system as described in any of the claims 1 to 5, wherein each wheel assembly is electrically powered.
- 7) A motorised transport system as described in any of the claims 6, wherein a slip ring electrically powers each wheel assembly.
- 30 8) A motorised transport system as described in any of claims 6 or 7, wherein the electrical powering and the data communication method are the same.

- 9) A motorised transport system as described in any claims 1 to 8, wherein the at least one control directional controller is a handset.
- 10) A motorised transport system as described in any claims 1 to 8, wherein the at least one control directional controller is integrated to the central control unit.
- 5 11) A motorised transport system as described in any claims 1 to 10, wherein the at least one directional controller is located on the motorized transport system.
- 12) A motorised transport system as described in any of the claims 1 to 11, wherein the position and direction information reader is an absolute encoder.
- 13) A motorised transport system as described in any of the claims 1 to 11, wherein
10 the position and direction information reader is an incremental encoder.
- 14) A motorised transport system as described in any of the claims 1 to 11, wherein the position and direction information reader is an accelerometer.
- 15) A motorised transport system as described in any of the claims 1 to 14, wherein the central control unit is a computer.
- 15 16) A motorised transport system as described in claim 15, wherein the computer comprises a processor unit, a memory unit, a storage device and a plurality of IO ports.
- 17) A motorised transport system as described in any of the claims 1 to 13, wherein the central control unit is a plurality of control units configured to provide parallel
20 or mesh computing.
- 18) A motorised transport system as described in any of the claims 1 to 17, wherein the at least one swivel wheel assembly is configured to communicate the wheel rotation position to the central control unit at predetermined frequency and wherein the central control unit analyzes and processes the rotation position from
25 the at least one wheel assembly and input information from the directional controller to calculate desired directional and rotational information of each wheel.
- 19) A method for moving a motorised transport system as claimed in any of the claims 1 to 18, wherein the method comprises the steps for:
- 30 a) the at least one control directional controller to select a direction;

- b) the control unit to read the current direction and rotation of the plurality of swivel wheel assemblies;
- c) the control unit to calculate the direction of rotation of each wheel according to the selected direction of the at least one control handset;
- d) the control unit to identify at least one wheel to act as a drive wheel among the plurality of wheels according to the selected direction of the at least one control handset;
- e) the control unit to communicate a rotation signal the at least one drive wheel.

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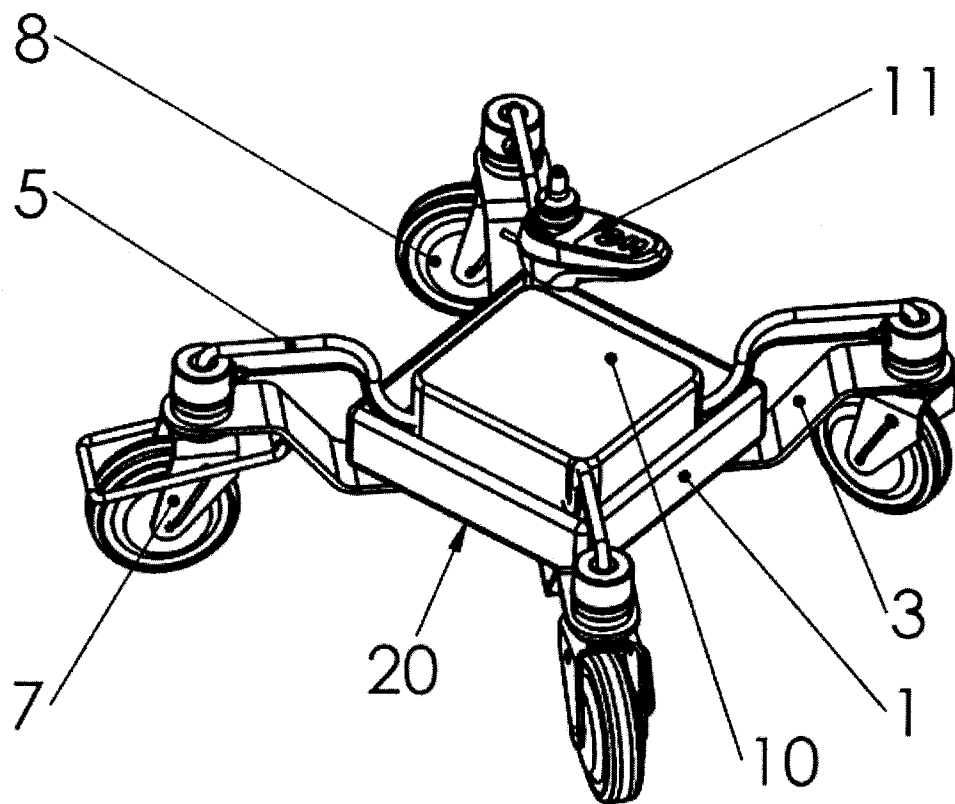
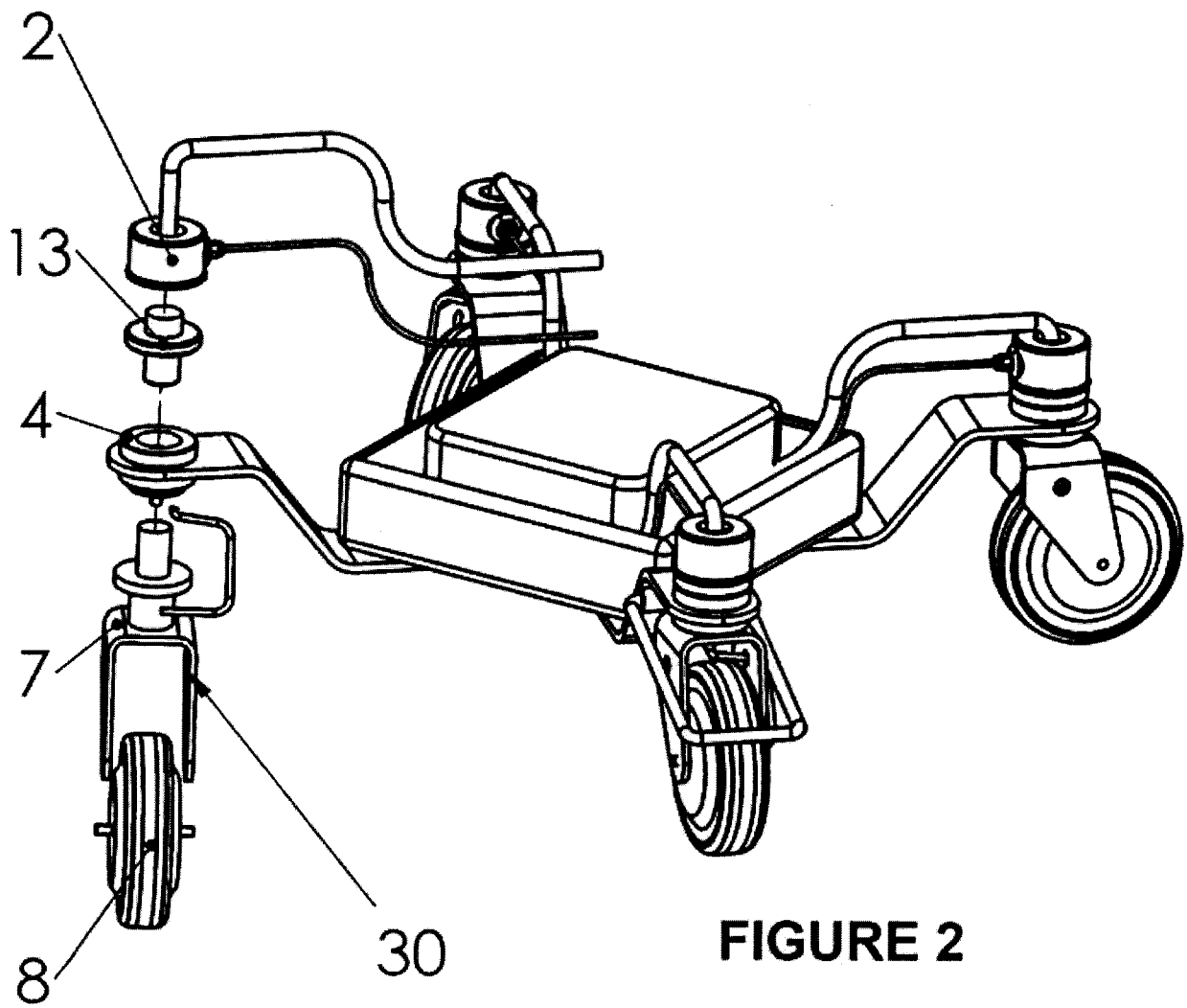


FIGURE 1



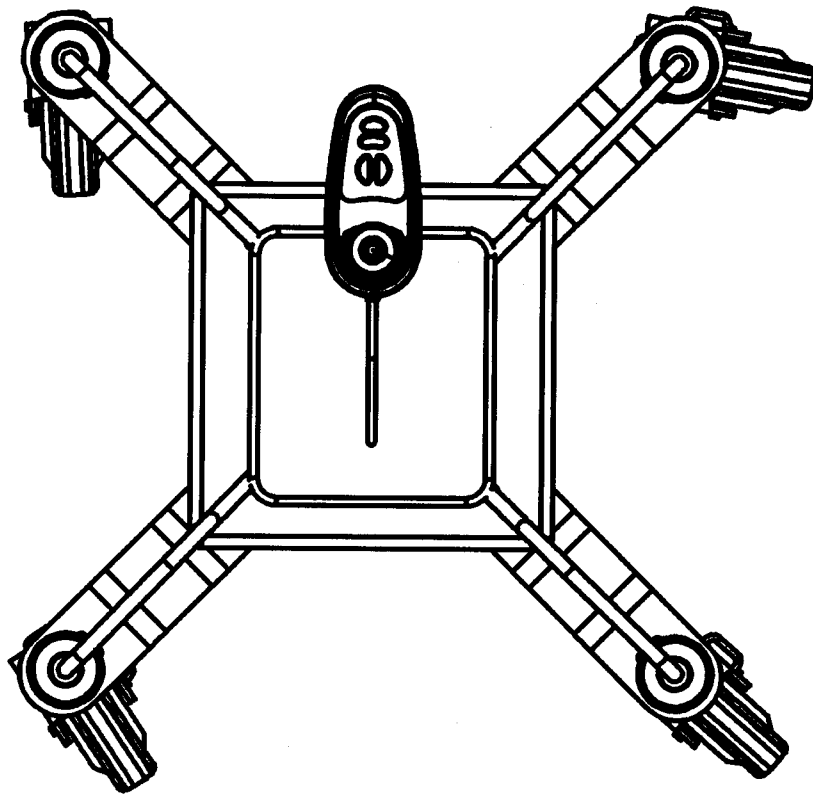


FIGURE 3



FIGURE 4

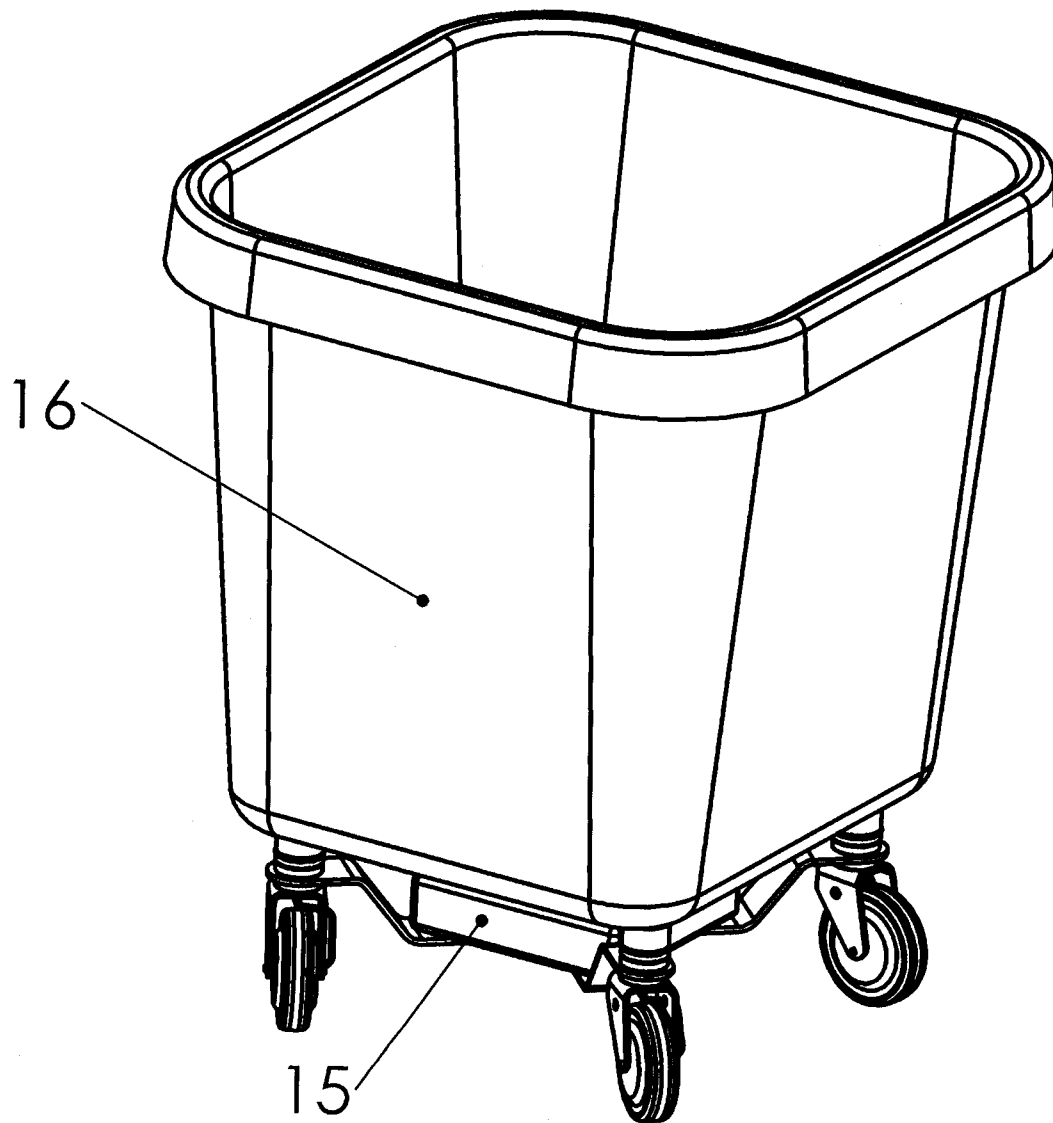


FIGURE 5

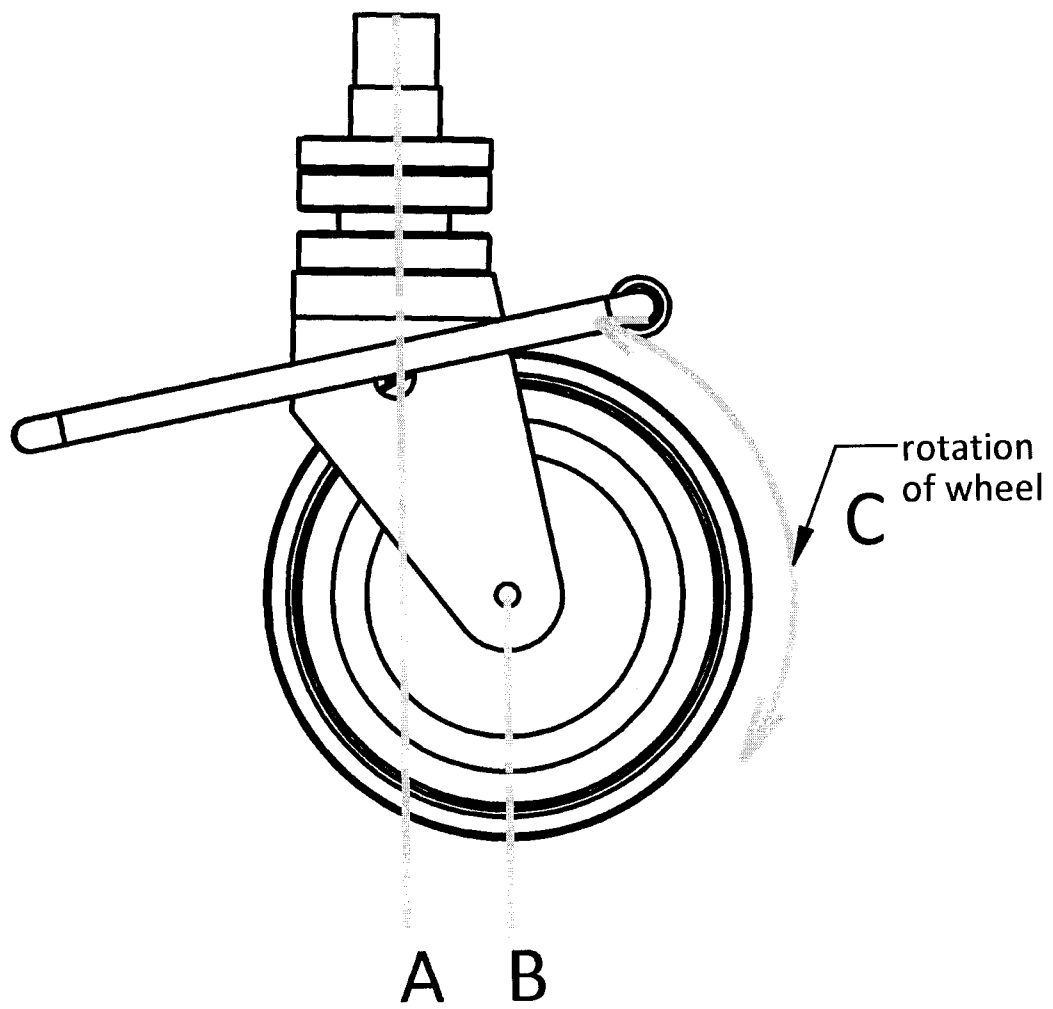


FIGURE 6

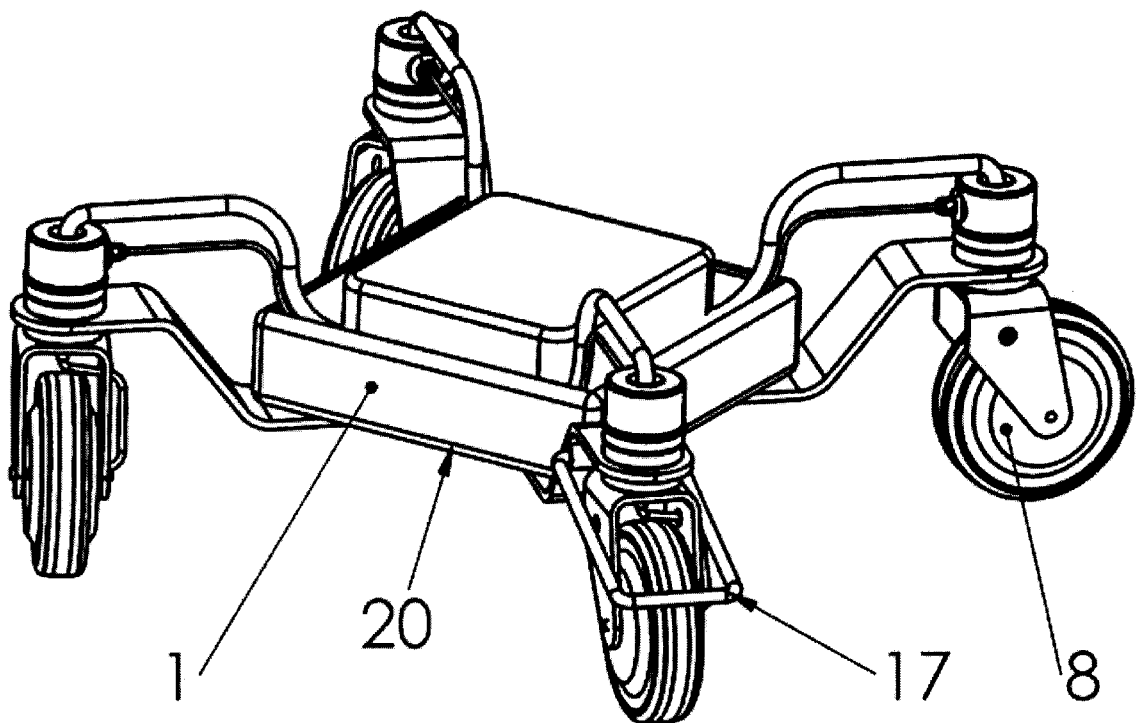


FIGURE 7

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC: **B62D 9/00** (2006.01) , **B60B 33/00** (2006.01) , **B60K 1/00** (2006.01) , **B60K 7/00** (2006.01) ,
B60L 15/00 (2006.01) , **B62B 3/00** (2006.01) (more IPCs on the last page)
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)

IPC(2006): B62D 9/00, B60B 33/00, B60K 1/00, B60K 7/00, B60L 15/00, B62B 3/00, B62B 5/00, B62D 51/04

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Databases: Canadian Patent Database (CPD), EPOQUE (X-Full, Epodoc)

Keywords: caster, motor, drive, electric, control

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US7689336B2 (SEGERLJUNG, M. et al.) 30 March 2010 (30-03-2010) *Abstract; Fig 3 and 12 *	1 - 3 and 10 - 19 4 - 9
Y	WO9954190A1 (SEGERLJUNG, M.) 28 October 1999 (28-10-1999) *Abstract; Fig 1 and 2*	4 - 9
A	US6540039B1 (YU, H. et al.) 01 April 2003 (01-04-2003) *The whole document*	1 - 19
A	JP2008137631A (KANEKO, Y. et al.) 19 June 2008 (19-06-2008) *The whole document*	1 - 19
A	US2002175018A1 (STRONG, R.) 28 November 2002 (28-11-2002) *The whole document*	1 - 19
A	EP0960769A2 (SATO, H. et al.) 01 December 1999 (01-12-1999) *The whole document*	1 - 19

[] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

17 August 2013 (27-08-2013)

Date of mailing of the international search report

30 August 2013 (30-08-2013)

Name and mailing address of the ISA/CA

Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001-819-953-2476

Authorized officer

Adeeb Zarifa (819) 934-2692

B62B 5/00 (2006.01) , *B62D 51/04* (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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		JP4321886B2	26 August 2009 (26-08-2009)
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