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(54) **COMMUNICATION SYSTEM AND METHOD FOR A VEHICLE**

(57) The present invention concerns a communication method and system for a vehicle, the system comprising:

- an emitter (11) comprising
i. a light emitting device (111) comprising multiple sources of light aligned with one another, and
ii. a light control system (112) configured for controlling the light emitting device (111);

- a receiver (12) comprising
i. a light detector (121), and
ii. a processing unit (122) configured for processing a signal outputted by the light detector (121);

wherein:

- one among the emitter (11) and receiver (12) is configured for being installed on-board the vehicle (3) and the other one on a road or track (2) over which the vehicle (3) is configured to move so that the light detector (121) is able to face the multiple light sources one after another during a motion of the vehicle (3) on said road or track (2);
- the light control system (112) is configured for encoding information in the light emitted by the light emitting device (111) and the processing unit (122) is configured for decoding said information from the signal outputted by the light detector (121).

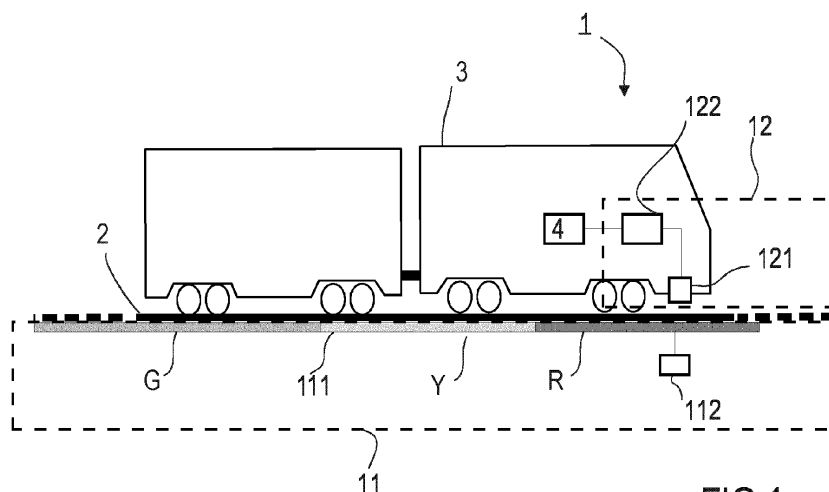


FIG 1

Description

[0001] The present invention concerns a communication system and method for a vehicle.

[0002] The present invention is essentially related to the field of guided vehicles, wherein the expression "guided vehicle" refers to public transport means such as subways, trains, or train subunits, which might be guided by one or several rails along a track, but also buses, etc., which might be guided by a line or a marking on a road or route. For said guided vehicles, guiding means like said track or the marking, define the trajectory of the vehicle, said trajectory being therefore predefined. More generally speaking, the concept of the present invention might also apply to any vehicle moving along a well-defined road or track, such as cars.

[0003] One problematic related to vehicles concerns the communication or exchange of information between the vehicle or vehicle driver and the ground, e.g. ground devices. For instance, traffic regulations, like speed limit, crossing priorities, moving priorities, etc. have to be communicated to the vehicle that is moving on a road or on a track. Usually, different types of ground devices are used for providing information to the vehicle or vehicle driver. For instance, signaling in roads, tracks, etc., is usually installed at certain points, i.e. at geographic positions, like signals and semaphores on road crossings, for providing traffic regulation information to the vehicle or driver. Another example is the use of track circuits and axle counters for detecting trains and informing an incoming train that it is safe to move forward. Another example is the use of beacons for providing information to a vehicle.

[0004] As described above, different devices are thus used for providing different information to the driver or to the vehicle. Unfortunately, the use of multiple devices for communicating different information to a vehicle increases the costs related to the vehicle road or track network, in particular the maintenance costs. Additionally, said different devices are each time located at a specific location or point along the road or track. The information is thus only distributed at fixed points. The local distribution of information may prevent a smooth moving of the vehicle in function of road or track conditions. This makes an efficient management of the vehicle energy not possible. For instance, it might be useful to stop a train at a location different from the one where a stop signal is installed, which is not possible when having a signal installed at a fix position. It might also be useful to provide a continuous information about the speed authorized for the vehicle, or to be able to provide at any point of a track or road information about an upcoming danger situation, for instance because a maintenance team is working on a portion of track. It would also be advantageous to increase the range over which a vehicle could continuously communicate with a ground device.

[0005] An objective of the present invention is to propose a multipurpose communication system and method

for a vehicle that can be used for communicating signaling information, and/or vehicle detection information, and/or traffic network information, and/or upcoming potential dangers on a followed road or track, and/or even for informing a maintenance team of an incoming vehicle.

[0006] For achieving said objective, the present invention proposes a communication system and method for a vehicle, i.e. that enables a communication with said vehicle, according to the objects of the independent claims. Other advantages of the invention are presented in the dependent claims.

[0007] The present invention concerns a communication system configured for transmitting a signal between said vehicle and a ground device installed on a road or track over which the vehicle is configured for moving, enabling notably to continuously provide information to the vehicle and/or vehicle driver. The communication between the vehicle and the ground (i.e. ground device) might preferentially take place continuously along a length of track or road over which said vehicle is moving or is going to move. Said communication might be implemented, for instance, along a section of said road or track, i.e. along a predefined length of said road or track, wherein said predefined length extends typically over several hundreds of meters or more, and includes preferentially a strategical point for vehicle traffic control, like a crossing or a station or a curve.

[0008] The communication system according to the invention comprises:

- an emitter comprising a light emitting device and a light control system configured for controlling the light emitting device. The light emitting device comprises a plurality of light sources aligned with one another according to a line, preferentially a straight line, that extends along a length L. The distance between two directly neighboring light sources is preferentially the same for all said multiple light sources;
- a receiver comprising a light detector, also called photodetector, and a processing unit configured for processing a signal outputted by the light detector;

wherein

- one among the emitter and receiver is configured for being installed on-board the vehicle and the other one on the road or track over which the vehicle is configured to move so that the light detector is able to face the multiple light sources one after another during a motion of the vehicle on said road or track. According to the present invention, each light source is configured for facing the light detector during a relative motion of the vehicle with respect to the road or track so that the light detector can successively detect the light emitted by the light sources during said relative motion. Typically, said line extends along the length of the vehicle when the emitter is installed on-board, or along the length of the road or

track when installed on said road or track, i.e. on the ground;

- the light control system is configured for encoding information in the light emitted by the light emitting device and the processing unit is configured for decoding said information from the signal outputted by the light detector.

[0009] The present invention also concerns a communication method comprising the following steps:

- receiving or acquiring, by an emitter, an information to be communicated to a receiver;
- automatically encoding said information in a light emitted by a light emitting device of the emitter, wherein said light emitting device comprises multiple light sources aligned with one another according to a line, preferentially straight line, that extends along a length L;
- receiving said light by means of a light detector of the receiver, wherein said receiver is configured for decoding said information from a signal outputted by the

[0010] light detector in response to the received light; wherein one among the emitter and receiver is configured for being installed on-board the vehicle and the other one on the road or track over which the vehicle is configured to move so that the light detector is able to face the multiple light sources one after another during a motion of the vehicle on said road or track. The light detector and one of said light sources are "facing each other" means that the light emitted by said light source is directed towards the light detector so that the latter can detect the emitted light. According to the present invention, the light detector and the light source are configured for interacting with one another when one of them is installed on the vehicle and the other one on the track or road, wherein, during a relative motion of the vehicle with respect to the road or track, the light detector is configured for successively detecting the light emitted by each of the light sources during said relative move of the vehicle.

[0011] Advantageously, having the multiple light sources extending according to a length L that is parallel to the direction of displacement of the vehicle enables a continuous interaction of the emitter with the receiver during at least some period of time, wherein said period of time during which said interaction is continuous is only limited by the length of the vehicle if the light sources are installed along the length of the vehicle. Indeed, if the light sources are installed on the ground, for instance between rails of a guided vehicle track, then the interaction might be continuous over several hundreds of meters as long as the detector successively faces a light source. A continuous interaction over a whole metro line could be for instance possible. Preferentially, the light sources might be installed at specific location, having thus a finite length L that defines the period of time during which said

interaction will be continuous. The continuity of the communication is thus only limited by the length L of extension of the multiple light sources. Said light sources are typically Light Emitting Diodes (LEDs), and said light emitting device is for instance a LED strip (also called ribbon light). The continuity of the communication might thus be only limited by the length L of a LED strip. The LED strip can be made of successive commercially available LED strips in order to reach said length L, for instance several hundreds of meters. By equipping a line of a railway network with such LED strips, it becomes thus possible to continuously provide information to a vehicle over a whole length of said line.

[0012] For example, the LED strip might be installed under the frame of the vehicle, extending according to the length of the latter, and/or on the road or track, extending according to the length of said road or track. The different light sources, e.g. LEDs, may take a different color and/or a different blinking frequency for encoding information and transmitting the latter to the light detector of the receiver. Regarding the communication, the wording "continuous" preferentially means that, from the first light source the light detector faces until the last light source it faces, the light detector will continuously get light of at least one light source during relative motion of the light detector with respect to the light sources from said first light source until said last light source.

[0013] Further aspects of the present invention will be better understood through the following drawings, wherein like numerals are used for like and corresponding parts:

Figure 1 schematic representation of a preferred embodiment according to the invention.

Figure 2 flowchart of a preferred method according to the invention.

Figure 3 schematic cross-sectional representation of a communication system according to the invention for a vehicle guided by rails.

Figure 4 schematic representation of a track equipped with the system according to the invention.

[0014] Figure 1 illustrates a preferred embodiment of a communication system 1 according to the invention. The communication system 1 comprises an emitter 11 and a receiver 12. The emitter 11 comprises a light emitting device 111 controlled by a light control system 112. The receiver 12 comprises a light detector 121 and a processing unit 122. According to a first alternative shown in Fig. 1 and 4, the emitter 11 might be installed on the ground, for instance on a track 2 over which the vehicle, e.g. a train 3, is moving. In the preferred embodiment of Fig. 1, the emitter 11 and receiver 12 cooperate with one another for transmitting information from the ground to the vehicle. Alternatively, the emitter 11 might

be installed on-board the vehicle 3 and the receiver 12 on the ground. In such a case, information might be transmitted from the vehicle to the ground. As shown in Fig. 3, both alternatives might be used together, that is the vehicle comprises both an emitter 11A and a receiver 12A, wherein the emitter 11A cooperates with a receiver 12B installed on the ground, and the receiver 12A cooperates with an emitter 11B installed on the ground. The on-board emitter 11A comprises an on-board light emitting device 111A controlled by an on-board light control system 112A. The on-board receiver 12A comprises an on-board light detector 121A and an on-board processing unit 122A. The ground emitter 11B comprises a ground light emitting device 111B controlled by a ground light control system 112B. The ground receiver 12B comprises a ground light detector 121B connected to a ground processing unit 122B. The processing unit and the light control system are devices comprising for instance a processor and optionally a memory. As shown in Fig. 3, the light control system and the processing unit might be implemented as a single device, e.g. a central processing unit CPU, that is configured for performing both the tasks of controlling the light emitting device and processing the signal outputted by the light detector. The on-board CPU, and respectively the ground CPU, is thus connected to both the light emitting device and light detector. Optionally, the communication system might comprise an additional on-board light detector 121A' and/or an additional on-board light emitting device 111A' that are connected to said on-board CPU or to a redundant CPU, as well as an additional ground light emitting device 111B' and/or additional ground light detector 121B' that are connected to the ground CPU or to a redundant ground CPU. If the system comprises redundant receivers and/or emitters, then the redundant devices will perform the same tasks, i.e. sending the same information, or analyzing the signal outputted by the light detector in the same way, so that the communication between the vehicle and the ground might continue even if a receiver and/or emitter fails. Additionally, using redundant devices transmitting the same information might enable the processing unit to compare the signal received from each light detector, i.e. to compare the information provided by each source of information, in order to detect, by comparison, whether there is any difference in the information transmitted, and if a difference occurs, then an action might be triggered, like stopping the vehicle. The vehicle, or respectively the ground, might thus comprise several emitters, wherein the lines over which the multiple light sources of said several emitters extend are parallel with one another and installed one next to the other, side by side according to their length. Alternatively, each of said emitters installed one next to the other, side by side, on the vehicle, or respectively ground, might be used for transmitting a different information to a receiver (each emitter transmitting thus to a different receiver) installed on the ground, respectively on the vehicle, so that the amount of information that can be simultaneously transmitted is increased.

[0015] Preferentially, if the light emitting device is installed on-board the vehicle 3, then one or several light detectors might be installed on the ground for facing the light sources of the light emitting device one after another when the vehicle 3 is moving on the track 2, the light detectors being thus aligned with one another, parallel to the line of the multiple light sources, forming themselves a light detector strip. Preferentially, the distance separating two directly successive light detectors installed on the ground is smaller or equal to the distance separating the two light sources that are the most far away from one another of the light emitting device installed on-board when considering the line according to which the multiple light sources extend. By this way, a continuous communication might be implemented between the vehicle and the ground, since the ground will always, i.e. at any time, detect the light of at least one light source of the guided vehicle. The distance separating two neighboring light detectors on the ground will thus depend for instance on the length of the light ribbon installed on the frame of the vehicle.

[0016] The communication method according to the invention will now be described in more details with respect to Fig. 2, together with Fig. 1, 3 and 4.

[0017] At step 201, a light control system of a ground, resp. on-board, emitter, for instance the emitter 11 of Fig. 1, receives or acquires information to be communicated to an on-board, resp. ground, receiver, for instance to the on-board receiver 12 of Fig. 1. The information to be communicated might be stored in a memory of the light control system 112. Said information might be sent to the ground emitter 11 by a remote-control center, or by another vehicle, or by a trackside device. Said information might be sent to the on-board emitter by an on-board device 4 of the vehicle 3, for instance a communication system or a control system of the vehicle 3.

[0018] In the case of an on-board emitter (see for instance ref. 11A in Fig. 3), said information might come from another on-board device 4 notably involved in the control of the vehicle 3 and connected to the light control system, or this information might result from data encoded in the light emitted by a previous ground emitter, received on-board by the on-board receiver, and that has to be transmitted to the next ground receiver by the on-board emitter. The information that has to be encoded by the light control system in the light emitted by the light sources might thus have numerous origins, coming for instance from a remote-control center, a trackside device, or another vehicle.

[0019] At step 202, the emitter according to the invention automatically encodes said information. The information is encoded by the light control system in the light emitted by the light sources of the light emitting device 111. The light control system may comprise predefined coding algorithms for encoding said information in the light emitted by the light sources. Said information might be notably encoded according to a blinking frequency and/or light color. The light emitting device and the light

control system are installed on the ground if the emitter is a ground emitter or on-board if the emitter is an on-board emitter. The "ground" light control system is typically installed on the track or close to the track and is connected to the "ground" light emitting device. The latter is preferentially installed between the rails of the track. The light emitting device 111 comprises multiple light sources aligned with one another, forming therefore a line, preferentially a straight line, extending along a length L. The alignment of the light sources is configured for enabling a successive detection of the light emitted by each of said light sources during a relative motion of the light detector and light sources, typically, when the vehicle moves over said light sources (if receiver on-board) or light detector(s) (if emitter on-board).

[0020] The light control system is preferentially configured for controlling each light source individually and/or independently. Consequently, each light source might be controlled by the light control system for encoding information that is different from the information encoded in the light of a directly neighboring light source. Preferentially, the light emitting device is configured for comprising at least two sets of light sources, wherein the light of the light sources belonging to a same set is configured for encoding a same information. Each set might thus be controlled independently from another set by the light control system, so that the vehicle passing over the successive sets of light sources will receive via its receiver a different information for each of the sets.

[0021] The light control system might encode the information in different ways:

- for instance, it can use a color encoding method, wherein information is encoded using different colors for the light emitted by the light sources;
- according to another embodiment, it can use a frequency encoding method. For instance, different blinking frequencies are used for encoding information in the light emitted by the light sources. Preferentially, the blinking frequencies are not perceptible for a human eye in order to not disturb the vehicle driver. The frequency encoding method may thus use a combination of periods of time, wherein the light is switched on during a first period of time, and then off during a second period of time that might be for instance different from the first one, and then again on during a third period of time that might be different from the first and second period of time, using thus, like in Morse code, a sequence of light on - light off for encoding the information;
- finally, it can also combine the color encoding method and the frequency encoding method.

[0022] Different predefined coding algorithms might be used for encoding the information, depending for instance on the source of information. For instance, color encoding might be used for encoding information regarding signaling information and/or potential danger infor-

mation, like the presence of another vehicle downstream, and/or the length of the vehicle (for instance the distance separating two light sources with same color might be a multiple of the length of the vehicle, while a blinking frequency is used for encoding its speed: from the knowledge of the measured time separating the detection of said two light sources with same color and the speed of the vehicle, a ground receiver might determine the vehicle length). Frequency encoding might be used for encoding other information, like a change of a timetable, or the speed of the vehicle when said information is transmitted to the ground.

[0023] According to the present invention, the light of the multiple light sources might be used for encoding and communicating various information, as well as visual information, i.e. designed for the driver or maintenance persons. For instance, as shown in Fig. 1 and 4, the ground emitter might set a first group G of successive light sources 11 with a first color, e.g. green, a second group Y of successive light sources with a second color different from the first color, e.g. yellow, and a third group R of successive light sources with a third color different from the first and second color, e.g. red, wherein the first group is adjacent to the second group that is itself adjacent to the third group. By this way, signaling information might be encoded in the color of the emitted lights and directly, i.e. visually, received by the vehicle driver, informing the latter to decrease the speed (yellow color), or to stop (red color), or that no danger has been detected (green color). At the same time, the receiver 12 installed on-board might analyze, through the signal outputted by the on-board detector, the color encoded light, and might automatically trigger appropriate measures if the vehicle driver does not adapt the displacement of the vehicle to the information encoded in the colors, for instance automatically stopping the vehicle or decreasing its speed.

[0024] For signaling purpose, the light emitting device comprises preferentially at least one RGB LED strip installed along a road or track to continuously provide information to the driver of the vehicle using different colors. The light control system might be configured for encoding different states, e.g. occupation states, of the road or track with different colors. Additionally, or alternatively, the light control system might use different colors for encoding an action that has to be carried out by the driver, or that might be automatically carried out by the vehicle after decoding of the information comprised in the light emitted by the emitter, said action being for instance reducing the speed if the color changes from green to yellow, or braking if it becomes red.

[0025] For instance, in the case of receivers and emitters equipping both the vehicle and the ground as shown in Fig. 3, a previous vehicle might use its on-board emitter to communicate its presence, and optionally its length, speed, itinerary, and other data, to a ground receiver via encoded light emitted by its emitter, wherein said ground receiver may store the received information in a memory of the CPU. When the light of a light source of a next

vehicle is detected by the light detector of the ground receiver, the CPU on the ground may encode information stored in its memory in the light emitted by the light emitting device of the ground emitter 11 in order to transmit said information to the receiver of the next vehicle. The same process applies mutatis mutandis with the on-board receiver and emitter. This enables a bi-directional communication with the ground.

[0026] Preferentially, the light sources installed on the ground are automatically switched-off when no light detector is at proximity. For this purpose, the multiple light sources of the light emitting device might be flanked at each extremity according to its length by a presence detector connected to the light control system, wherein said presence detector is configured for detecting the presence of a vehicle at proximity, said presence being then communicated to the light control system by a signal indicating said presence. In such a case, the light control system is configured for automatically starting to send information to the vehicle via its light sources when it receives said signal indicating the presence of the vehicle from one of the presence detectors, said sending of information automatically stopping, e.g. the light sources being automatically switched off, as soon as the vehicle passed, i.e. as soon as the light control system receives said signal indicating said presence from the other one of the presence detectors. If the vehicle comprises a light emitting device according to the invention, then said presence detector can be a light detector configured for detecting the light of the vehicle emitter. Advantageously, automatically turning on/off the light of the light sources when a vehicle passes might be used for automatically preventing maintenance personnel working on the road or track that a vehicle is going to pass within the next minutes or seconds. Alternatively, any other technique known in the art might be used for detecting an absence or presence of the vehicle at proximity of the emitter and informing the latter accordingly, in order to trigger an automatic start of the sending of information by the emitter to the receiver when a presence of a vehicle is detected and automatically stopping said sending once said vehicle passed, i.e. once the presence of the vehicle is not anymore detected, for instance after a predefined period of time.

[0027] At step 203, the information sent by the emitter is received by the receiver. More precisely, the light detector 121 of the receiver is configured for detecting the light emitted by the multiple light sources of the light emitting device when there is a relative motion of the light detector with respect to said light sources, the light detector being configured for facing said light sources one after another during said relative motion. In particular, the light detector and the multiple light sources are aligned in a same place, the light detector being separated by a constant distance from the line of light sources when they are submitted to a relative motion with respect to one another. Thus, the communication of information between the receiver and the emitter takes place during

a motion of the vehicle over a road or track, said motion enabling the relative motion of the light detector with respect to the light sources.

[0028] In order to enable the light detector to detect successively the light emitted by each of the light sources of the emitter, the direction of extension of the line according to which the light sources are aligned is preferentially parallel to the direction of displacement of the vehicle, i.e. usually parallel to the track or road, when said vehicle is moving on said track or road. As already explained, if the emitter is installed on-board, then the receiver is installed on the ground, and at the opposite, if the emitter is installed on the ground, then the receiver is installed on-board. According to the example of Fig. 1, the receiver, and thus its light detector 121, is installed on-board. The light detector 121 is configured for facing, one after another, the multiple light sources of the light emitting device when the vehicle is moving on the track or road. For instance, the light emitting device is a LED strip installed under a frame of the vehicle (see ref. 111A or 111A' in Fig. 3) or on the ground (see ref. 111 in Fig. 1) with its length extending parallel to the direction of displacement of the vehicle, typically parallel to the track or road when the vehicle is moving over the latter. Thus, when a vehicle, comprising on-board such a light emitting device, is moving over a portion of track or road equipped with one or several successive and aligned light detectors, or, when a vehicle, comprising on-board said light detector, is moving over a portion of track or road equipped with said light emitting device, then the light detector faces successively the different light sources of the light emitting device, from the first light source until the last light source, and for each light source passing at a close proximity to the light detector and facing the latter, a corresponding signal is outputted by the light detector. Said signal will notably depend on the blinking frequency of the light and its color, and is thus correlated to the information that was encoded by the light control system in the light transmitted by the light emitting device.

[0029] At step 204, the receiver is configured for decoding said information from the signal outputted by the light detector in response to the received light. More precisely, the processing unit of the receiver is configured for decoding said signal outputted by the light detector in order to retrieve the information encoded in the light by the light control system of the emitter. For this purpose, a decoding method, that is for instance based on the coding algorithms of the light control system, might be used by the processing unit. Additionally, the signal outputted by the light detector might be temporally tagged. The processing unit might be further configured for acquiring speed information about the current speed of the vehicle, wherein said speed information enables the processing unit to determine the speed of the vehicle in function of the time. The speed of the vehicle in function of the time might be used by the processing unit for determining, from the signal outputted by the light detector, that is preferentially temporally tagged, the information

that was encoded in the light emitted by the sources of light.

[0030] At step 205, the decoded information might be further transmitted by the processing unit to a device 4 involved in the control of the vehicle or involved in the control of vehicle traffic over said track or road, or to an emitter of the communication system in order to be transmitted to a next vehicle.

[0031] The present invention enables thus a communication between the ground and a vehicle using light emitted by multiple light sources aligned with one another to encode said information. Advantageously, if the vehicle and the ground are equipped with the emitter and receiver according to the invention, then detection of the vehicle and bi-directional communication with the latter becomes possible. On one hand, blinking and/or colors of the different lights emitted by the light emitting device will be detected by the light detector installed on-board, and the processing unit of the receiver will decode the information sent by the emitter. On the other hand, the emitter installed on-board can at the same time provide information to the receiver installed on the ground, wherein the processing unit of the ground receiver will decode the information sent by the on-board emitter. The information received by the processing unit installed on the road or track may send this information (e.g. speed, length, wheel diameter, etc.) to a control center, or radio block center (RBC) or interlocking, etc., and the control center, RBC, interlocking, etc., may send information to the vehicle (e.g. movement authority, speed limit, braking command, etc.) through the light emitted by the road or track emitter.

[0032] To summarize, the present invention proposes a new way of communication for a vehicle based on the use of an array of multiple light sources, wherein said multiple light sources aligned with one another along the length of the road or track and installed on the ground makes it possible to continuously communicate with the vehicle, providing for instance to the latter continuous signaling information, the present invention further enabling a detection of a vehicle and a communication from the vehicle to the ground when said multiple light sources are installed on the vehicle. The present invention may replace numerous tracksides or on-board devices. For instance, thanks to the present invention, a driver might be informed to stop at any point of a track or road equipped with an emitter, replacing therefore usual signal devices. Also, state of the art track circuits can be replaced by the present invention, wherein occupancy and information about presence or absence of vehicles on a track might be encoded in the light emitted by the emitter, as well as the management of movement authority, wherein light detectors installed on the ground are configured for detecting vehicles through the light emitted by their emitter, and a CPU installed on the ground is configured for managing movement authority of the different detected vehicles, encoding then movement authorities in the light emitted by the ground emitter, enabling a re-

ceiver to communicate to a vehicle control system whether the vehicle is authorized or not to move forward, wherein said movement authority can additionally be visually represented along the track by the light emitted by the ground emitter.

Claims

1. A communication system (1) for a vehicle (3), said communication system (1) comprising:

- an emitter (11) comprising

- i. a light emitting device (111) comprising multiple sources of light aligned with one another, and
- ii. a light control system (112) configured for controlling the light emitting device (111);

- a receiver (12) comprising

- i. a light detector (121), and
- ii. a processing unit (122) configured for processing a signal outputted by the light detector (121);

wherein:

- one among the emitter (11) and receiver (12) is configured for being installed on-board the vehicle (3) and the other one on a road or track (2) over which the vehicle (3) is configured to move so that the light detector (121) is able to face the multiple light sources one after another during a motion of the vehicle (3) on said road or track (2);
- the light control system (112) is configured for encoding information in the light emitted by the light emitting device (111) and the processing unit (122) is configured for decoding said information from the signal outputted by the light detector (121) .

2. Communication system (1) according to claim 1, comprising at least two of said emitters (11) and at least two of said receivers (12), so that both the vehicle (3) and the road or track (2) can be equipped with at least one emitter (11) and at least one receiver (12), wherein each emitter (11) configured for being installed on-board the vehicle (3) is configured for cooperating with at least one of the receivers (12) configured for being installed on the road or track (2), and wherein each receiver (12) configured for being installed on-board is configured for cooperating with at least one emitter (11) configured for being installed on the road or track (2) .

3. Communication system (1) according to claim 2, wherein information received by the receiver (12) configured for being installed on-board is different from information simultaneously transmitted by the emitter (11) configured for being installed on-board. 5
 4. Communication system (1) according to one of the claims 1 to 3, wherein at least one emitter (11) configured for being installed on the road or track (2) is configured for transmitting information regarding an occupancy state of the road or track (2). 10
 5. Communication system (1) according to claim 4, wherein the occupancy state is color-encoded. 15
 6. Communication system (1) according to one of the claims 1 to 5, wherein at least one emitter (11) configured for being installed on-board the vehicle (3) is configured for encoding information regarding the vehicle in its emitted light. 20
 7. Communication system (1) according to one of the claims 1 to 6, wherein the decoded information is transmitted to a control system (4) involved in the control of the vehicle (3). 25
 8. Communication system (1) according to one of the claims 1 to 7, wherein the light control system (112) is configured for automatically starting to send information to a receiver when a presence of a vehicle is detected and for automatically stopping the sending once said vehicle passed. 30
 9. Communication method for a vehicle (3) configured for moving over a road or track (2), the method comprising the steps: 35
 - receiving (201), by an emitter (11), an information to be communicated to a receiver (12);
 - automatically encoding (202) said information in a light emitted by a light emitting device (111) of the emitter (11), wherein said light emitting device (111) comprises multiple light sources aligned with one another; 40
 - receiving (203) said light by means of a light detector (121) of a receiver (12), wherein said receiver (12) is configured for decoding (204) said information from a signal outputted by the light detector (121) in response to the received light; 45
 10. Communication method according to claim 9, wherein the emitter (11) is installed on the road or track (2) and the communication method further comprises encoding an occupancy state of said road or track (2) in the light emitted by the emitter (11).
 11. Communication method according to claim 10, comprising communicating additional information from an additional emitter installed on-board the vehicle (3) to an additional receiver installed on the road or track (2).
 12. Communication method according to claim 9, wherein the emitter (11) is installed on-board the vehicle (3), and the communication method further comprises encoding information regarding the vehicle in the light emitted by the emitter (11).
 13. Communication method according to claim 12, comprising communicating additional information from an additional emitter installed on the road or track (2) to an additional receiver installed on-board the vehicle (3).
 14. Communication method according to one of the claims 9 to 13, comprising transmitting (205), by means of the receiver (12), the decoded information to a control system (4) involved in the control of the vehicle (3).
 15. Communication method according to one of the claims 9 to 14, comprising automatically starting to send information to a receiver when a presence of a vehicle is detected and automatically stopping the sending once said vehicle passed. 55
- wherein one among the emitter (11) and receiver (12) is configured for being installed on-board the vehicle (3) and the other one on the road or track (2) over which the vehicle (3) is configured to move so that the light detector (121) is facing the multiple light sources one after another during a motion of the vehicle (3) on said road or track (2).

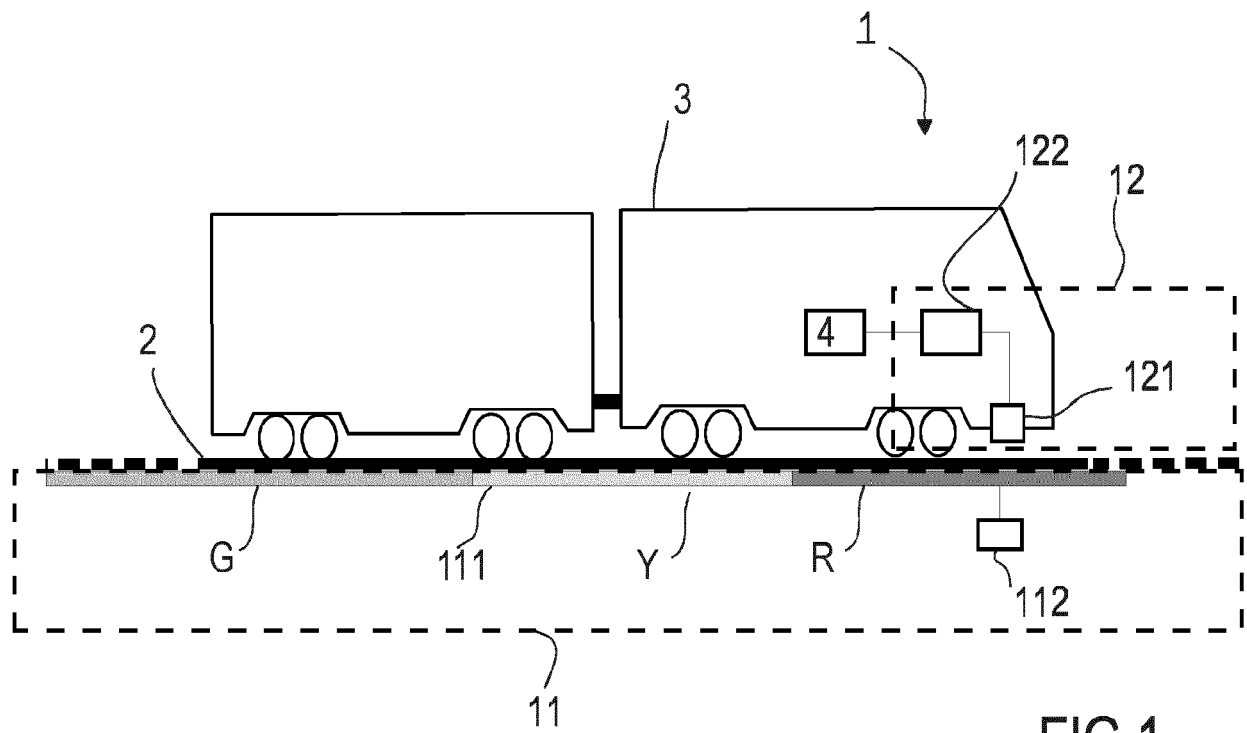


FIG 1

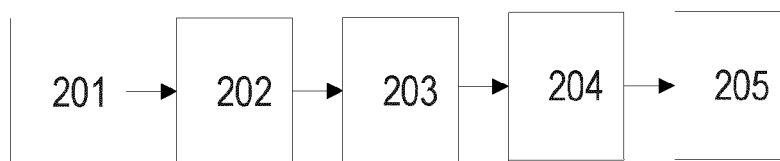


FIG 2

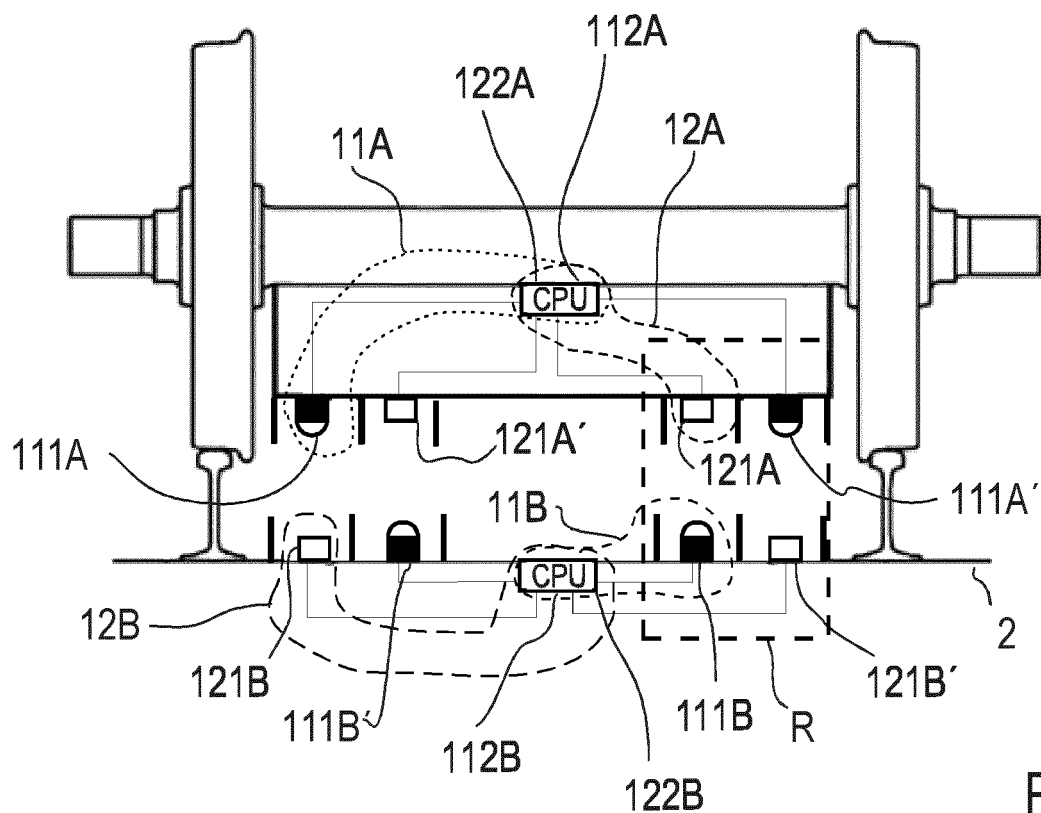


FIG 3

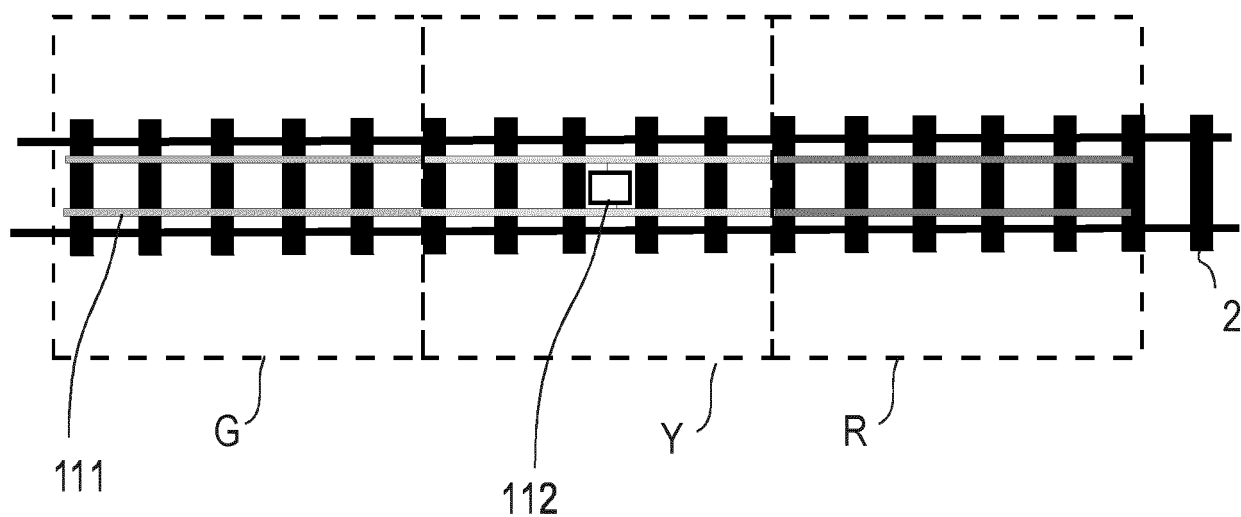


FIG 4



EUROPEAN SEARCH REPORT

Application Number

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A	DE 25 52 507 B2 (SIEMENS AG) 29 December 1977 (1977-12-29) * figure 1; paragraphs [0019] - [0026] *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B61L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 January 2022	Examiner Plützer, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-01-2022

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	US 1742614	A	07-01-1930	NONE

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82