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(71) Applicant: **Bombardier Transportation GmbH**
10785 Berlin (DE)

(72) Inventors:
- **Täng, Fredrik**
18356 Täby (SE)
- **Jonsson, Lars**
16246 Vällingby (SE)
- **Ranta-Eskola, Harri**
75230 Uppsala (SE)

(74) Representative: **Patentanwälte Bressel und Partner mbB**
Potsdamer Platz 10
10785 Berlin (DE)

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Amended claims in accordance with Rule 137(2) EPC.

(54) **A method and a system for monitoring the operability of a balise**

(57) A method and system for monitoring the operability of a balise (2) for transmitting information to a rail vehicle (7), wherein a tele-powering signal (10) emitted by the rail vehicle (7) is received by the balise (2), wherein a telegram switch inhibit signal (RS) is generated by the balise (2) and transmitted to a balise-related control unit (3) upon reception of the tele-powering signal (10), wherein the operability of the balise (2) is monitored depending on the telegram switch inhibit signal (RS).

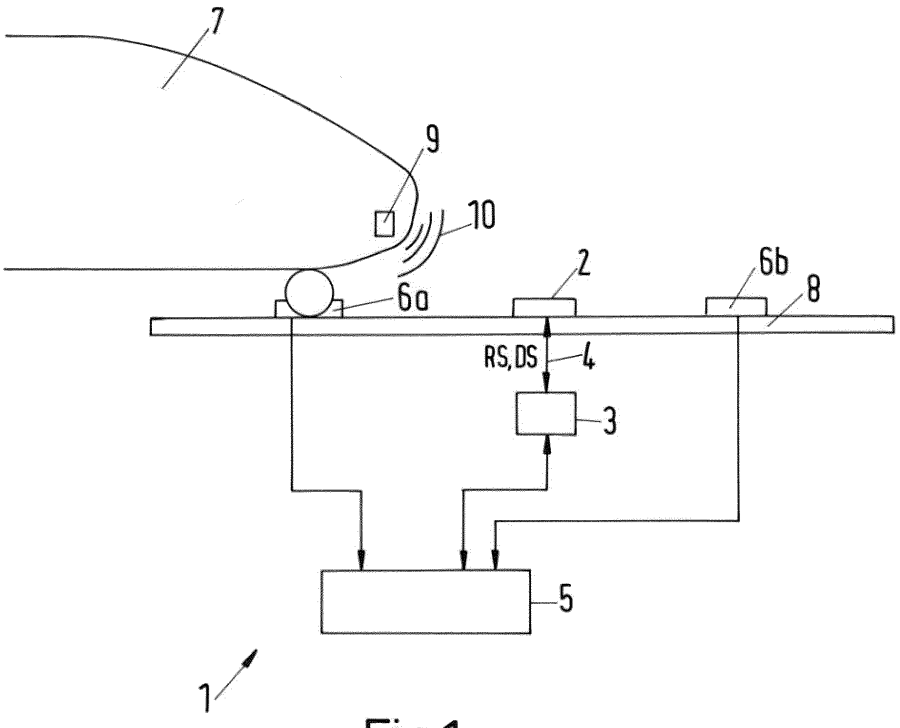

Fig.1

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Description

[0001] The invention relates to a method and a system for monitoring the operability of a balise for transmitting information to a rail vehicle.

[0002] It is known that an interlocking computer or control unit controls and monitors various devices along a railway line in modern railway signalling systems. Among the most important wayside objects are point machines and lamp signals. Traditionally, lamp signals have been monitored by the interlocking control unit by measuring the current which flows through the lamp and checking if said current is within predetermined limits. If the lamp fails, the failure will affect the current and can thus be detected by the interlocking control unit which, in turn, generates an alarm signal. Similarly, the current deliverance to a point machine can be measured and monitored and the status of the point machine can be monitored depending on said current. Should the point machine fail, the failure will be detected when the point machine is ordered to reverse and an alarm signal can be generated.

[0003] Track-sided transmitters, which can be also referred to as balises, which are used to send information to passing trains, cannot be monitored in this way. If, for instance, a cable connecting the balise and a balise-related control unit breaks, the failure is not automatically detected by the control unit. Similarly, if the balise should fail or be ripped off its sleeper, the control unit will not detect it. Furthermore, cable breakage or failure of the balise will result in restrictive action by the rail vehicles but it is not always clear that something is broken or missing. The driver of the rail vehicle is supposed to report failures of the balise but such reports are usually irregular.

[0004] The document DE 10 2009 012 986 A1 describes a method for operating a system for controlling a rail vehicle. A track-sided electronic control unit selects a data signal depending on a signal term and transmits said signal to a balise which is arranged on a track. Furthermore, the balise receives an activation signal which is sent by a vehicle-sided antenna. During reception of the activation signal, a request signal is transmitted to the electronic control unit. The data signal is transmitted from the track-sided control unit to the balise during the time interval of reception of the request signal.

[0005] The communication disclosed in DE 10 2009 012 986 A1 is, however, not compatible with the European Standard ERTMS/ECTS Class 1 FFFIS for Eurobalise, SUBSET-036. Said standard standardises a balise-based ATP-telegram (automatic train protection telegram) transmission between way-sided elements and train-sided elements and serves as a starting point for this invention.

[0006] There is the technical problem to provide a system and a method for monitoring the operability of a balise for transmitting information to a rail vehicle, wherein a fast, reliable and robust monitoring of a balise, e.g. of an incorrect or a correct operation and/or an incorrect or correct connection, is provided.

[0007] The solution to said technical problem is provided by the subject matter according to claims 1 and 10.

[0008] It is a main idea of the invention to monitor the operability of the balise depending on the telegram switch inhibit signal which is generated by the balise and transmitted to the balise-related control unit.

[0009] A method for monitoring the operability of a balise for transmitting information to a rail vehicle is proposed. Monitoring the operability comprises to monitor a correct or incorrect operation or operability of the balise. Monitoring the operability can also comprises to monitor a correct or incorrect connection of the balise to e.g. a balise-related control unit. Thus, a balise-related fault detection can be provided by the proposed method.

[0010] In the context of this invention, the term "balise" refers to any type of track-sided transmitter. The balise is usually arranged on a track for a rail vehicle. The balise is capable of transmitting information, e.g. in form of one or more data signals, to the rail vehicle traveling on the track.

[0011] A data signal can be generated by a balise-related control unit which is connected to balise. The data signal can contain information on e.g. a maximal admissible velocity and/or a position of the balise and/or a position of the next balise along the track. These pieces of information can be transmitted from the balise to the rail vehicle and can be evaluated by a vehicle-sided control unit, e.g. in order to control certain operations on the rail vehicle. The data signal can be generated in form of a data telegram, in particular in the form of the aforementioned ATP-telegram.

[0012] It is possible that data signals, e.g. data telegrams, are generated continuously and transmitted to the balise with no interruptions, wherein the balise-related control unit transmits the data signal continuously, regardless of whether there is a rail vehicle passing the balise or not. In this context, passing can mean that the rail vehicle is or arrives at a position at which the information transmitted by the balise can be received by the rail vehicle or that the rail vehicle is or arrives at a position at which a tele-powering signal, which will be explained in the following, transmitted by the rail vehicle can be received by the balise.

[0013] Further, the tele-powering signal emitted by the rail vehicle, e.g. by a vehicle-sided antenna, is received by the balise. In order to receive said tele-powering signal, the balise can comprise at least one corresponding receiving means. Upon reception of the tele-powering signal, a telegram switch inhibit signal is generated by the balise and transmitted to the balise-related control unit. The telegram switch inhibit signal can be used for inhibiting switching of the data signal, in particular the data telegram, in the balise-related control unit during a passage of the balise, e.g. by the rail vehicle.

[0014] The balise-related control unit denotes a unit which controls an operation of the balise. The tele-powering signal can be also referred to as activation signal.

[0015] In order to generate the telegram switch inhibit

signal, the balise can comprise corresponding generating means. The balise can be connected to the balise-related control unit in a wireless or tethered way.

[0016] After having received the telegram switch inhibit signal, the balise-related control unit can suspend a change of current the data signal, in particular a change of the data telegram, for a predetermined amount of time. The amount of time can be chosen such that no change of the data signal occurs during the actual balise passage. This is called back-signalling. This back-signalling ensures that a rail vehicle does not only receive the end of one data signal, in particular data signal in form of a data frame or telegram, and the beginning of another data signal.

[0017] According to the invention, the operability of the balise is monitored depending on the telegram switch inhibit signal, in particular characteristics or properties of the telegram switch inhibit signal.

[0018] For example, the operability of the balise can be monitored depending on whether a telegram switch inhibit signal is received by the balise-related control unit, in particular at an expected time instant of reception or within a certain expected time interval of reception.

[0019] Also, in particular if a telegram switch inhibit signal has been received by the balise-related control unit, the operability of the balise can be monitored depending on the time instant of reception of the telegram switch inhibit signal, in particular depending on the difference between the time instant of reception and an expected time instant of reception. In other words, an expected time instant or an expected time interval of reception of the telegram switch inhibit signal by the balise-related control unit is determined, wherein the operability of the balise can be monitored depending on whether a telegram switch inhibit signal is received by the balise-related control unit at the expected time instant or within the expected time interval.

[0020] Alternatively or cumulatively, the operability can be monitored depending on data content and/or a telegram switch inhibit signal format and/or other properties or characteristics of the telegram switch inhibit signal.

[0021] An incorrect operation or connection can e.g. be detected if at least one property or characteristic of the telegram switch inhibit signal, in particular of the previously described properties or characteristics, does not match a predetermined characteristic or property or differs from predetermined characteristic or property more than a predetermined threshold value. An incorrect operation or connection can e.g. be detected if no telegram switch inhibit signal is received by the balise-related control unit at the expected time instant or within the expected time interval. A correct operation or connection can e.g. be detected if a telegram switch inhibit signal is received by the balise-related control unit at the expected time instant or within the expected time interval.

[0022] The proposed method advantageously allows monitoring the operability of the balise based on existing signals generated during operation of the balise. This, in turn, means that no additional equipment has to be installed. Further, the proposed method allows a fast and reliable monitoring as the telegram switch inhibit signal can be analyzed easily. Another advantage is that the proposed method can be used as an add-on to the European Standard ERTMS/ECTS Class 1 FFFIS for Eurobalise, SUBSET-036 as it is compatible with said standard. In particular, no changes of the standard or the communication interfaces of the balise and the balise-related control unit are required.

[0023] In another embodiment, position information of rail vehicles are determined. Position information can e. g. comprise position coordinates of the rail vehicle, in particular along the track, and a time instant corresponding to a position of the rail vehicle. It is possible that the position and a corresponding time instant is measured and saved during the travel of the rail vehicle along the track. This can be done continuously or sequentially. To determine position information, a means for determining position information can be used, e.g. a GNSS-based system or any other position detection system. Said embodiment, however, may require a rail vehicle which comprises an equipment for transmitting information, e.g. in the form of ATP telegrams, to the wayside, e.g. to the balise. Of course, such an equipment also needs to be activated. Further, information on a travel speed of the rail vehicle can be determined, e.g. by a speed sensor, and, if applicable, transmitted to the wayside. Said travel speed information can be used to determine an expected position or expected position interval which was or is reached in or after a given time interval or to determine an expected time or an expected time interval which was or is needed to reach a given position.

[0024] The position information is compared to balise-related rail vehicle passage information. Said passage information can e.g. comprise a time instant at which the rail vehicle passes the balise. The vehicle passage information can also contain a position of the balise, e.g. in form of coordinates.

[0025] The operability of the balise is monitored depending on the comparison of the position information and the balise-related rail vehicle passage information. In particular, the operability can be monitored depending on the comparison of said pieces of information at a certain time instant, in particular time instant at which the vehicle passes the balise. It is, for example, possible that an expected time instant or expected time interval of a passage of the rail vehicle of the balise is determined based on the position information and compared to an actual time instant of reception of the telegram switch inhibit signal. This will be explained later.

[0026] The time instant at which the vehicle passes the balise can e.g. be defined as the time instant of reception of the telegram switch inhibit signal by the balise-related control unit. Thus, it is not mandatory that the rail vehicle or at least a part of the rail vehicle has already passed the balise.

[0027] The comparison can e.g. be performed by a cor-

relation of said signals. It is possible, that a similarity measure of said pieces of information is determined or calculated. The similarity measure can e.g. be determined depending on a difference between the time instant of the passage of the rail vehicle of balise and the expected time instant at which the rail vehicle reaches the position of the balise which is determined based on the aforementioned position information. The similarity measure can e.g. increase with a decreasing difference. A correct operability can e.g. be detected, if the similarity measure is higher than e.g. a predetermined threshold value. In turn, an incorrect operability of the balise can be detected if the similarity measure is equal to or smaller than the threshold value.

[0028] The position information is determined independently of the determination of the vehicle passage information. This can e.g. mean that different means, e. g. sensors, are used to determine the position information (or at least a part of these information) and the vehicle passage information.

[0029] By comparing position information of the rail vehicle and vehicle passage information, a simple but robust and reliable method for monitoring the operability is provided.

[0030] In another embodiment, the position information of the rail vehicle is determined depending on the output signal of at least one track circuit. The track circuit denotes an electrical device which can be used to detect the absence of a rail vehicle on the track. If a rail vehicle is present, an electric connection between two rails of the track is provided by the wheels and an axle of e.g. locomotives and/or rolling stocks, wherein the track circuit is shortened. If said rail vehicle is absent, the electrical circuit is consequently interrupted. By monitoring the track-circuit, e.g. a current flow through the track circuit, the absence or presence of a rail vehicle can be detected.

[0031] This advantageously allows a simple determination of the absence or presence of a rail vehicle. If a position of the track circuit is known, position information of the rail vehicle can be determined based on monitoring the track circuit.

[0032] In an alternative embodiment, the position information of the rail vehicle is determined depending on the output signal of at least one axle counter. An axle counter denotes a device on a track that detects the passing of a rail vehicle. As each axle of a rail vehicle passes a head or counting head of the axle counter, the counter increments. If a position of the axle counter is known, position information can be simply determined by the axle counter.

[0033] This advantageously allows determination of position information by usually existing equipment.

[0034] In a preferred embodiment, the position information is correlated to the balise-related rail vehicle passage information. As explained later, it is for instance possible to determine an expected time course of a vehicle passage information based on the position information. Said determined time course can be correlated to a time course of the rail vehicle passage information.

[0035] The time course can e.g. be a binary time course, wherein a function takes a first value at the time instant at which the rail vehicle passes the balise and another value at all remaining time instances.

[0036] A correlation advantageously allows a simple determination of a similarity measure which is, furthermore, reliable. This, in turn, allows a more reliable monitoring of the operability.

[0037] In another embodiment, an expected time instant or an expected time interval of a rail vehicle passage of the balise is determined depending on the position information of the rail vehicle and the position of the balise. The expected time instant or expected time interval denotes a time instant or time interval at which or in which a vehicle passage of the balise was or is expected. The expected time instant or expected time interval can thus lie in the past or in the future.

[0038] The position of the balise can be known beforehand. Depending on said known position and position information, the time instant or the time interval at/in which the rail vehicle has passed or will pass the position of a balise can be determined. It is also possible to predict said time instant or time interval, e.g. based on a current rail vehicle position and a velocity or travel speed of the rail vehicle.

[0039] The expected time instant or expected time interval of the rail vehicle passage is compared to a detected time instant of a rail vehicle passage of the balise unit. The detected time instant is determined depending on the reception of the telegram switch inhibit signal by the balise-related control unit. The operability of the balise is monitored depending on the comparison of the expected time instant or expected time interval of the expected rail vehicle passage and the detected time instant of a rail vehicle passage of the balise unit. Comparison can e.g. be performed by calculating a difference between the said time instances or a difference between the detected time instant and limits or a central value of the expected time interval. If the difference is higher than predetermined threshold value, an incorrect operability can be detected. If the difference is smaller than or equal to the threshold value, a correct operability can be detected.

[0040] This provides a simple but robust method of monitoring the operability.

[0041] In an alternative embodiment, a rail vehicle passage of the balise is detected depending on the reception of the telegram switch inhibit signal by the balise-related control unit. Furthermore, an expected position or expected position interval of the rail vehicle is determined based on the rail vehicle positioning information and the time instant of the detected rail vehicle passage. It is for instance possible, to determine the position at which the rail vehicle was located or will be located at the time instant of the rail vehicle passage of the balise.

[0042] The operability of the balise is monitored de-

pending on the comparison of the position of the balise and the expected position or expected position interval of the rail vehicle. Comparison can e.g. be performed by calculating a difference between the position of the balise and the expected position or a difference between the position of a balise and limits or a central value of the position interval of the rail vehicle. If the difference is higher than the threshold value, an incorrect operability of the balise can be detected. If the difference is smaller than or equal to the threshold value, a correct operability of the balise can be detected.

[0043] This advantageously provides an alternative method for fast and robust monitoring of the operability of the balise.

[0044] In another embodiment, the operability of the balise is monitored by an interlocking control unit. It is possible that balise-related control unit is connected to the interlocking control unit, e.g. in a tethered or wireless way. The interlocking control unit can e.g. control an operation of other railway-related systems, in particular an operation of at least one signalling means such as lamp signals and/or an operation of at least one controlling means such as a point machine.

[0045] Furthermore, the previously described means for determining position information of the rail vehicle, in particular the previously described track circuit and/or axle counters, can be connected to the interlocking control unit. Thus, the interlocking control unit can perform the previously described comparison.

[0046] In another embodiment, an alarm signal is generated if at least one criterion for a correct operability of the balise is not met. This means that in case an incorrect operability is detected, an alarm signal such as an acoustic, optic or haptic alarm signal can be generated.

[0047] Further proposed is a system for monitoring the operability of a balise for transmitting information to a rail vehicle. The system comprises at least one balise and a balise-related control unit. The balise and the balise-related control unit can be connected in order to transmit information, e.g. in form of data signals or data frames.

[0048] A tele-powering signal emitted by the rail vehicle is receivable by the balise. A telegram switch inhibit signal is generatable by the balise and transmittable to the balise-related control unit upon reception of the tele-powering signal.

[0049] According to the invention, the system comprises at least one monitoring means, wherein the operability of the balise is monitorable by the at least one monitoring means depending on the telegram switch inhibit signal. The monitoring means can e.g. be integrated into the balise-related control unit. Preferably, the monitoring means are integrated in an interlocking control unit, which will be explained later.

[0050] The proposed system advantageously allows performing one of the previously described methods.

[0051] In another embodiment, position information of the rail vehicle is determinable, wherein the position information is comparable to balise-related rail vehicle passage information, wherein the operability of the balise is monitorable depending on the comparison of the position information and the balise-related rail vehicle passage information.

[0052] In a preferred embodiment, the system comprises at least one means for determining vehicle position information.

[0053] In a further preferred embodiment, the at least one means for determining vehicle position information is provided by a track circuit or an axle counter.

[0054] In another embodiment, the system comprises an interlocking control unit, wherein the operability of the balise is monitorable by the interlocking control unit. The interlocking control unit can be connected to the previously described balise-related control unit. The interlocking control unit hereby denotes a central control unit which, as explained previously, also controls operation of other railway-related devices or systems.

[0055] In another embodiment, the balise is connected to the balise-related control unit by a cable. In this embodiment, a correct or incorrect operability of the cable can also be monitored.

[0056] The invention will be described with reference to the attached figure.

[0057] Fig. 1 shows a schematic block diagram of a system 1 for monitoring the operability of a balise 2. The system comprises the balise 2 and a balise-related control unit 3. The balise-related control unit 3 and the balise 2 are connected by a cable 4. Furthermore, the system 1 comprises a central interlocking control unit 5 and a first track circuit 6a and another track circuit 6b. The track circuits 6a, 6b are arranged with a predetermined distance to each other along a track 8 at predetermined positions. It is shown that the balise 2 is arranged in between the track circuits 6a, 6b along a direction of travel.

[0058] A rail vehicle 7 travels along the track 8. Rail vehicle 7 comprises an antenna 9 for transmitting a tele-powering signal 10. The tele-powering signal 10 is received by the balise 2. A telegram switch inhibit signal RS is generated by the balise 2 and transmitted to the balise-related control unit 3 via the cable 4. The balise-related control unit 3 generates data signals DS and transmits these data signals DS to the balise 2 which, in turn, transmits these data signals DS to the rail vehicle 7.

[0059] By monitoring a circuit (not shown) of the track circuits 6a, 6b, a position of the rail vehicle 7 can be determined. The position of the track circuits 6a, 6b and the balise 2 is known. Upon reception of the telegram switch inhibit signal RS by the balise-related control unit 3, a vehicle passage of the balise 2 is detected. The corresponding time instant is determined and saved by the interlocking control unit 5. Also, time instants of the passage of the rail vehicle 7 of the first track circuit 6a and the second track circuit 6b are determined and saved.

[0060] After the rail vehicle 7 has passed the second track circuit 6b, which is arranged behind the balise 2 and the first track circuit 6a along the direction of travel of the rail vehicle 7, the detected time instant of the rail

vehicle passage of the balise 2 is compared to a expected time interval, wherein limits of the time interval are provided by the time instants of the passages of the rail vehicle 7 of the first and the second track circuits 6a, 6b. If the expected time instant of the rail vehicle passage of the balise 2 lies within the time interval, a correct operation of the balise 2 can be detected. Alternatively, a correct operation can be detected, if the expected time instant of the rail vehicle passage of the balise 2 corresponds to the central time instant of the time interval or differs not more than a predetermined amount from said central time instant. In all other cases, an incorrect operability of the track sided transmitter 2 can be detected. In this case, the interlocking unit 5 can generate an alarm signal and, if applicable, activate a fail safe operation of selected or all other systems or devices controlled by the interlocking control unit 5.

Claims

1. A method for monitoring the operability of a balise (2) for transmitting information to a rail vehicle (7), wherein a tele-powering signal (10) emitted by the rail vehicle (7) is received by the balise (2),
wherein a telegram switch inhibit signal (RS) is generated by the balise (2) and transmitted to a balise-related control unit (3) upon reception of the tele-powering signal (10),
characterized in that
the operability of the balise (2) is monitored depending on the telegram switch inhibit signal (RS).

2. The method according to claim 1, wherein a position information of the rail vehicle (7) is determined, wherein the position information is compared to balise-related rail vehicle passage information, wherein the operability of the balise (2) is monitored depending on the comparison of the position information and the balise-related rail vehicle passage information.

3. The method according to claim 2, wherein the position information of the rail vehicle (7) is determined depending on the output signal of at least one track circuit (6a, 6b).

4. The method according to claim 2, wherein the position information of the rail vehicle (7) is determined depending on the output signal of at least one axle counter.

5. The method according to one of the claims 2 to 4, wherein the position information is correlated to the balise-related rail vehicle passage information.

6. The method according to one of the claims 2 to 5, wherein an expected time instant or an expected time interval of a rail vehicle passage of the balise (2) is determined depending on the position information of the rail vehicle (7) and the position of the balise (2), wherein the expected time instant or expected time interval of the rail vehicle passage is compared to a detected time instant of a rail vehicle passage of the balise unit (2), wherein the detected time instant is determined depending on the reception of the telegram switch inhibit signal (RS) by the balise-related control unit (3), wherein the operability of the balise (2) is monitored depending on the comparison of the expected time instant or expected time interval of the expected rail vehicle passage and the detected time instant of the rail vehicle passage of the balise (2).

7. The method according to one of the claims 2 to 5, wherein a rail vehicle passage of the balise (2) is detected depending on the reception of the telegram switch inhibit signal (RS) by the balise-related control unit (3), wherein an expected position or position interval of the rail vehicle (7) is determined based on the rail vehicle positioning information and the time instant of the detected rail vehicle passage, wherein the operability of the balise (2) is monitored depending on the comparison of the position of the balise (2) and the expected position or position interval of the rail vehicle (7).

8. The method according to one of the claims 1 to 7, wherein the operability of the balise (2) is monitored by an interlocking control unit (5).

9. The method according to one of the claims 1 to 8, wherein an alarm signal is generated if at least one criterion for a correct operability of the balise (2) is not met.

10. A system for monitoring the operability of a balise (2) for transmitting information to a rail vehicle (7), wherein the system (1) comprises at least one balise (2) and a balise-related control unit (3), wherein an tele-powering signal (10) emitted by the rail vehicle (7) is receivable by the balise (2), wherein a telegram switch inhibit signal (RS) is generatable by the balise (2) and transmittable to a balise-related control unit (3) upon reception of the tele-powering signal (10),
characterized in that
the system (1) comprises at least one monitoring means, wherein the operability of the balise (2) is monitorable by the at least one monitoring means depending on the telegram switch inhibit signal (RS).

11. The system according to claim 10, **characterized in that** a position information of the rail vehicle (7) is determinable, wherein the position information is comparable to balise-related rail vehicle passage information, wherein the operability of the balise (2) is

monitorable depending on the comparison of the position information and the balise-related rail vehicle passage information.

12. The system according to claim 11, wherein the system (1) comprises at least one means for determining vehicle position information.

13. The system according to claim 12, wherein the at least one means for determining vehicle position information is provided by a track circuit (6a, 6b) or an axle counter.

14. The system according to claim 10 to 13, wherein the system comprises an interlocking control unit (5), wherein the operability of the balise (2) is monitorable by the interlocking control unit (5).

15. The system according to one of the claims 10 to 14, wherein the balise (2) is connected to the balise-related control unit (3) by a cable (4).

Amended claims in accordance with Rule 137(2) EPC.

1. A method for monitoring the operability of a balise (2) for transmitting information to a rail vehicle (7), wherein a tele-powering signal (10) emitted by the rail vehicle (7) is received by the balise (2),
wherein a telegram switch inhibit signal (RS) is generated by the balise (2) and transmitted to a balise-related control unit (3) upon reception of the tele-powering signal (10),
characterized in that
the operability of the balise (2) is monitored depending on the telegram switch inhibit signal (RS), wherein a position information of the rail vehicle (7) is determined, wherein the position information is compared to balise-related rail vehicle passage information, wherein the operability of the balise (2) is monitored depending on the comparison of the position information and the balise-related rail vehicle passage information, wherein an expected time instant or an expected time interval of a rail vehicle passage of the balise (2) is determined depending on the position information of the rail vehicle (7) and the position of the balise (2), wherein the expected time instant or expected time interval of the rail vehicle passage is compared to a detected time instant of a rail vehicle passage of the balise unit (2), wherein the detected time instant is determined depending on the reception of the telegram switch inhibit signal (RS) by the balise-related control unit (3), wherein the operability of the balise (2) is monitored depending on the comparison of the expected time instant or expected time interval of the expected rail vehicle passage and the detected time instant of the rail vehicle passage of the balise (2).

2. The method according to claim 1, wherein the position information of the rail vehicle (7) is determined depending on the output signal of at least one track circuit (6a, 6b).

3. The method according to claim 1, wherein the position information of the rail vehicle (7) is determined depending on the output signal of at least one axle counter.

4. The method according to one of the claims 1 to 3, wherein the position information is correlated to the balise-related rail vehicle passage information.

5. The method according to one of the claims 1 to 4, wherein the operability of the balise (2) is monitored by an interlocking control unit (5), wherein the balise-related control unit (3) and a means for determining position information of the rail vehicle (7) are connected to the interlocking control unit (5), wherein the interlocking control unit (5) performs the comparison.

6. The method according to one of the claims 1 to 5, wherein an alarm signal is generated if at least one criterion for a correct operability of the balise (2) is not met.

7. A system for monitoring the operability of a balise (2) for transmitting information to a rail vehicle (7), wherein the system (1) comprises at least one balise (2) and a balise-related control unit (3), wherein an tele-powering signal (10) emitted by the rail vehicle (7) is receivable by the balise (2), wherein a telegram switch inhibit signal (RS) is generatable by the balise (2) and transmittable to a balise-related control unit (3) upon reception of the tele-powering signal (10),
characterized in that
the system (1) comprises at least one monitoring means, wherein the operability of the balise (2) is monitorable by the at least one monitoring means depending on the telegram switch inhibit signal (RS), wherein a position information of the rail vehicle (7) is determinable, wherein the position information is comparable to balise-related rail vehicle passage information, wherein the operability of the balise (2) is monitorable depending on the comparison of the position information and the balise-related rail vehicle passage information,wherein an expected time instant or an expected time interval of a rail vehicle passage of the balise (2) is determinable depending on the position information of the rail vehicle (7) and the position of the balise (2), wherein the expected time instant or expected time interval of the rail vehicle passage is comparable to a detected time instant of a rail vehicle passage of the balise unit (2),

wherein the detected time instant is determinable depending on the reception of the telegram switch inhibit signal (RS) by the balise-related control unit (3), wherein the operability of the balise (2) is monitorable depending on the comparison of the expected time instant or expected time interval of the expected rail vehicle passage and the detected time instant of the rail vehicle passage of the balise (2).

8. The system according to claim 7, wherein the system (1) comprises at least one means for determining vehicle position information.

9. The system according to claim 8, wherein the at least one means for determining vehicle position information is provided by a track circuit (6a, 6b) or an axle counter.

10. The system according to claim 7 to 9, wherein the system comprises an interlocking control unit (5), wherein the operability of the balise (2) is monitorable by the interlocking control unit (5), wherein the balise-related control unit (3) and the means for determining position information of the rail vehicle (7) are connected to the interlocking control unit (5), wherein the interlocking control unit (5) performs the comparison.

11. The system according to one of the claims 7 to 10, wherein the balise (2) is connected to the balise-related control unit (3) by a cable (4).

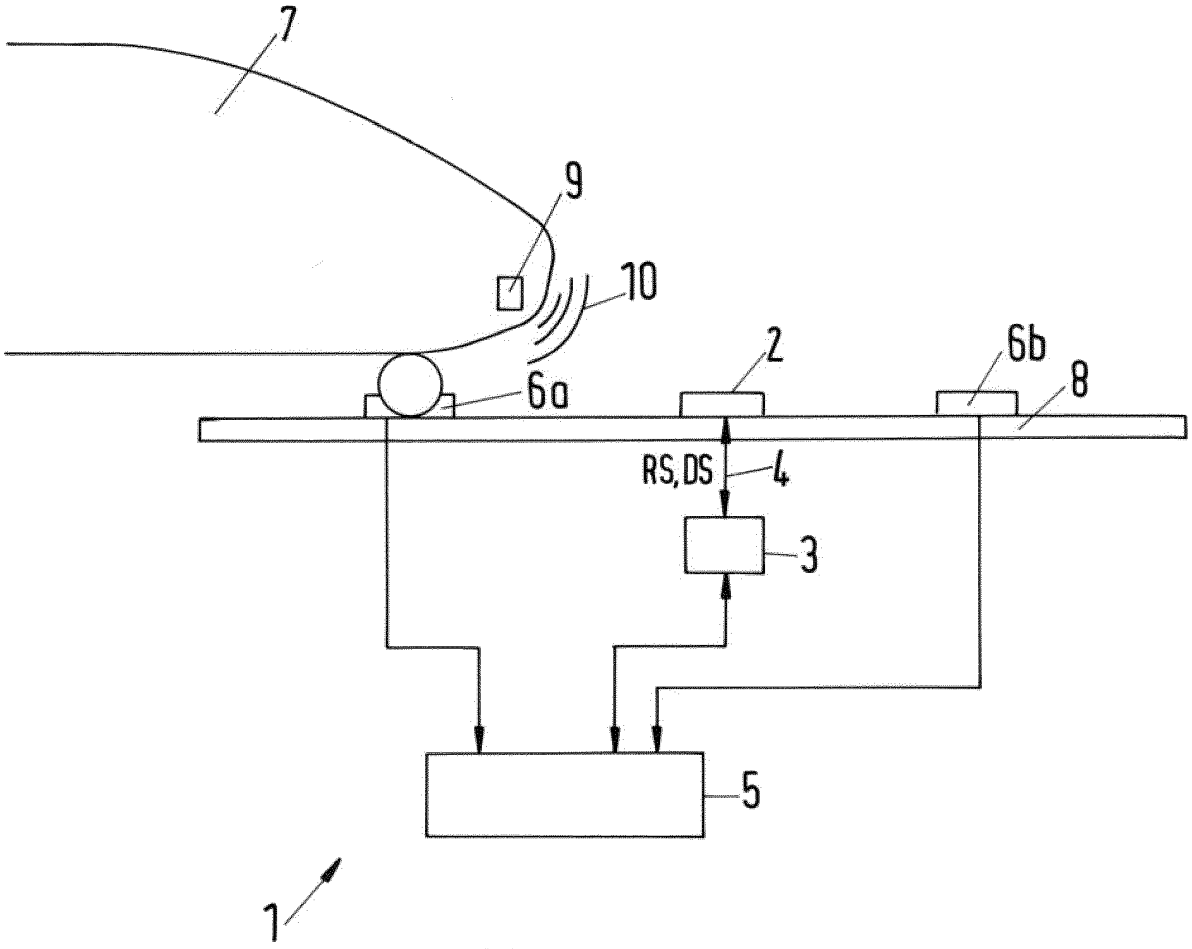

Fig.1

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 3300

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	"ERTMS/ETCS FFFIS for Eurobalise", , 24 February 2012 (2012-02-24), pages 1-157, XP055112059, Retrieved from the Internet: URL:http://www.era.europa.eu/Document-Register/Documents/Set-2-Index009-SUBSET-036 v300.pdf [retrieved on 2014-04-03]	1,8-10, 14,15	INV. B61L3/12 B61L27/00 B61L25/02
Y	* Chapter 4.1.3.2 External Interfaces; page 21 *	2,5,11, 12	
A	* Chapter 5.1; page 52 * * Chapter 5.2.2.6; page 63 - page 64 * * Chapter D4.3; page 147 *	3,4,6,7, 13	
Y	WO 2007/113128 A1 (SIEMENS AG [DE]; APEL NORBERT [DE]; STRAHL JENNY [DE]) 11 October 2007 (2007-10-11) * page 1, line 14 - page 2, last line *	2,5,11, 12	

TECHNICAL FIELDS SEARCHED (IPC)

B61L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 April 2014	Janhsen, Axel

CATEGORY OF CITED DOCUMENTS

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

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