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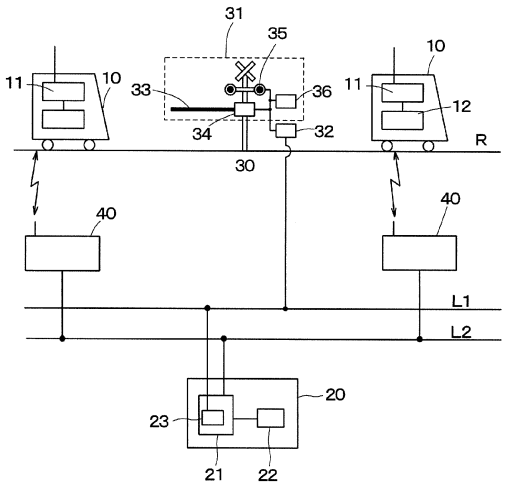
(54) POWER-SAVING MANAGEMENT SYSTEM FOR GROUND EQUIPMENT

(57) Provided is a power-saving service management system that temporarily operates ground equipment only upon passage of a train. The power-saving service management system includes a train that travels on a track, a management center that performs service management on each train and a railroad crossing apparatus, and the railroad crossing apparatus arranged on the track. When the train approaches the railroad crossing apparatus, the center apparatus temporarily powers a railroad crossing protection device of the railroad crossing apparatus from OFF to ON to bring the railroad crossing protection device into an operable state from a non-operable state, and after passage of the train through the railroad crossing apparatus in the operable state, returns the railroad crossing protection device of the railroad crossing apparatus to the original non-operable state. The center apparatus repeats such processing until the train arrives at a destination.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a power-saving service management system that controls a train moving on a track and ground equipment arranged on the track.

2. Description of Related Art

[0002] JPH01-132469U discloses a railway signaling apparatus including station devices separately provided at stations and configured to reduce power consumption in such a manner that a station device at a certain station into which a train has entered and a station device at a station before the certain station are brought into an operable state by turning on power sources thereof and power sources of station devices at other stations are turned off.

[0003] The station device separately provided at each station includes a power source ON/OFF circuit and an interlocking unit, and the power source ON/OFF circuit turns on and off power input based on train position information provided from interlocking units at adjacent stations and brings the station device into the operable state or a non-operable state.

[0004] JP2012-201270A discloses a railroad crossing protection device that cuts off lifting-lowering control performed by an electronic control circuit when, e.g., the electronic control circuit is broken down and forcibly lowers a crossing gate pole by a relay control circuit. The railroad crossing protection device maintains the crossing gate pole lowered by the weight itself at a lowered position until the broken circuit is recovered and the lifting-lowering control is resumed.

SUMMARY OF THE INVENTION

[0005] However, in the railway signaling apparatus of JPH01-132469U, the power source is turned on and off in units of station device, and for this reason, cannot be turned on and off for each piece of ground equipment arranged on a track at a station and the periphery thereof, such as a railroad crossing protection device.

[0006] Power is constantly supplied to ground equipment installed between stations and arranged on a track, such as the railroad crossing protection device of JP2012-201270A, other than the station device. This leads to a problem that extra power is consumed.

[0007] In a case where the number of trains to be operated is small and the volume of traffic across a railroad crossing is great, when a failure of a railroad crossing apparatus occurs, a crossing gate pole is forcibly lowered even in a state in which no train is present close thereto. This leads to a problem that a vehicle or a pedestrian cannot cross the railroad crossing at all.

[0008] An object of the present invention is to solve the above-described problems and provide a power-saving service management system that temporarily operates ground equipment only upon passage of a train to reduce the power consumption of the ground equipment and avoids a state of a vehicle or a pedestrian not being able to cross a railroad crossing because a crossing gate pole is kept lowered due to a failure of a railroad crossing apparatus which is the ground equipment although no train approaches the railroad crossing apparatus.

[0009] According to the power-saving service management system of the present invention, when the train approaches a railroad crossing apparatus, the center apparatus repeats processing of temporarily powering a railroad crossing protection device of the railroad crossing apparatus from OFF to ON to bring the railroad crossing protection device from the non-operable state to the operable state and returning the railroad crossing protection device of the railroad crossing apparatus to the original non-operable state after the train has passed through the railroad crossing apparatus in the operable state until the train arrives at an arrival point. The railroad crossing protection device of the railroad crossing apparatus is temporarily operated only upon passage of the train so that the power consumption of the railroad crossing apparatus can be reduced.

[0010] Further, in a state in which the train does not approach the railroad crossing apparatus, a crossing gate pole of the railroad crossing protection device is kept lifted. Thus, a state of the crossing gate pole being lowered regardless of the position of the train due to a failure as in a railroad crossing protection device using a relay control circuit in the related art is avoided. Consequently, in a state in which the train does not approach the railroad crossing apparatus, a vehicle or a pedestrian is not limited from crossing the railroad crossing apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a system configuration diagram of a power-saving service management system;

FIG. 2 is a flowchart of power supply to a railroad crossing apparatus;

FIG. 3 is a route map showing a positional relationship between a train and the railroad crossing apparatus;

FIG. 4 is a route map showing the train having passed through a power-ON position and the railroad crossing apparatus which is an interference point;

FIG. 5 is a route map showing the railroad crossing apparatus and the train in a state in which the interference point has been deactivated;

FIG. 6 is a route map showing the railroad crossing apparatus and the train having passed therethrough;

FIG. 7 is a route map showing the railroad crossing

apparatus and the train in a case where the interference point is not deactivated; and

FIG. 8 is a route map showing the train and the railroad crossing apparatus in a state in which the train stops before the railroad crossing apparatus.

DESCRIPTION OF EMBODIMENTS

[0012] The present invention will be described in detail based on an embodiment shown in the figures.

[0013] FIG. 1 is a configuration diagram of a power-saving service management system, and this power-saving service management system includes a train 10 traveling on a track R, a management center 20 that performs service management for each train 10 and ground equipment arranged on the track R, a railroad crossing apparatus 30 which is the ground equipment connected to the management center 20 and arranged on the track R, and a wireless communication unit 40 connected to the management center 20 to communicate with each train 10 via a wireless communication line.

[0014] The railroad crossing apparatus 30 and the management center 20 are connected to each other via a first communication network L1, and the wireless communication unit 40 and the management center 20 are connected to each other via a second communication network L2.

[0015] Note that the first communication network L1 and the second communication network L2 are shown as wired networks in the figures, but may be wireless networks. Further, the first communication network L1 and the second communication network L2 may be one network.

[0016] The wireless communication unit 40 which is a base station having a predetermined range of a communication area is placed, for example, at certain intervals, and the communication areas thereof partially overlap with each other so that disconnection of communication between the train 10 and the management center 20 can be avoided. Communication between the train 10 and the management center 20 is not necessarily made via the wireless communication line, and may be made via a loop antenna or a leaky coaxial cable laying along the track R as the wireless communication unit 40.

[0017] The train 10 is provided with an antenna unit 11 that exchanges various types of information with the wireless communication unit 40 and an on-board device 12 connected to the antenna unit 11. Train information processed by the on-board device 12 and including, e.g. , the train ID, traveling speed, and traveling position of the train 10 is transmitted as needed to the management center 20 via the antenna unit 11 and the wireless communication unit 40.

[0018] The traveling speed in the train information is calculated, for example, based on a rotating speed detected by a tachometer attached to an axle. Moreover, the traveling position is calculated, for example, as a milage. Alternatively, a GPS terminal may be mounted to transmit latitude-longitude information as the traveling position. Further, the on-board device 12 controls, e.g., the speed of the train 10 according to command information, such as speed control information, transmitted from the management center 20.

[0019] The management center 20 placed, for example, at any station in the power-saving service management system includes a center apparatus 21 connected to the first communication network L1 and the second communication network L2 and an operation terminal 22 connected to the center apparatus 21 and operated by an operator.

[0020] The center apparatus 21 includes an arithmetic control unit 23 that controls, e.g. , lifting and lowering of a crossing gate pole for the railroad crossing apparatus 30, and a so-called server device including not-shown arithmetic processing unit and storage unit is used as the arithmetic control unit 23.

[0021] The center apparatus 21 receives various types of information from the train 10 and the railroad crossing apparatus 30 as needed, stores these types of information in the storage unit, and appropriately transmits various types of command information to the train 10 and the railroad crossing apparatus 30 through arithmetic processing in service management control by the arithmetic processing unit as described later.

[0022] The operation terminal 22 is a so-called client device connected to the center apparatus 21, and using, e.g. , a route map displayed on a not-shown monitor device, can monitor, e.g., the traveling position and traveling speed of each train based on the train information from each train 10 and the state of lifting and lowering of the crossing gate pole of the railroad crossing apparatus 30 as needed. Further, the operator can perform various types of setting processing, make a control command, etc. via a not-shown input unit such as a keyboard or a mouse.

[0023] The railroad crossing apparatus 30 arranged on the track R includes a railroad crossing protection device 31 to be operated according to the command information from the center apparatus 21 and a control unit 32 that controls drive of the railroad crossing protection device 31 and ON/OFF of a power source of the railroad crossing protection device 31.

[0024] The railroad crossing protection device 31 includes a lifting-lowering unit 34 that lifts and lowers a crossing gate pole 33, an alarming unit 35 that outputs alarm sound and alternately blinks a pair of lamps, and an obstacle detection unit 36 that detects an obstacle in a railroad crossing. Note that the crossing gate pole 33 and the lifting-lowering unit 34 are equivalent to a so-called crossing gate.

[0025] When ON/OFF of the power supply is controlled for the railroad crossing protection device 31 and the railroad crossing protection device 31 is supplied with power and brought into an operable state based on a command from the center apparatus 21, the control unit 32 controls lifting and lowering of the crossing gate pole

33 by the lifting-lowering unit 34, controls alarming by the alarming unit 35, and controls report of each detection state of the obstacle detection unit 36 to the center apparatus 21.

[0026] The control unit 32 may control ON/OFF of the power supply only for the railroad crossing protection device 31 based on a command from the center apparatus 21. In this case, when the railroad crossing protection device 31 is supplied with power by the ON control of the power supply by the control unit 32 and is brought into the operable state, the control of the lifting-lowering unit 34, the alarming unit 35, and the obstacle detection unit 36 is started, and report control of each unit reporting a control state to the center apparatus 21 is performed.

[0027] FIG. 2 is a flowchart of power supply control performed by the center apparatus 21 for the railroad crossing apparatus 30 through which the train 10 is about to pass. The train 10 starts traveling on the track R after a traveling route has been set for the on-board device 12.

[0028] Note that the center apparatus 21 grasps, as needed, the traveling position of each train 10, the railroad crossing apparatus 30 which may be an interference point interfering with traveling of the train 10, etc. from the train information transmitted from each train 10 traveling on the track R via the wireless communication unit 40, but does not necessarily receive information on the route from the train 10.

[0029] After the start of the flowchart shown in FIG. 3, a railroad crossing apparatus 30n positioned ahead of the train 10 and closest to the train 10 is set as an interference point S interfering with traveling of the train 10 in Step ST1. In this case, the center apparatus 21 transmits interference point information set with the interference point S to the train 10, and the train 10 having received such interference point information sets the interference point S present ahead.

[0030] This is because for the train 10 which is about to pass through the railroad crossing apparatus 30, the railroad crossing apparatus 30 in a state in which the crossing gate pole 33 is at a lifted position and a pedestrian and a vehicle can cross the railroad crossing is the interference point S interfering with traveling.

[0031] Subsequently, in Step ST2, it is determined whether the train 10 has reached a power-ON position P1 which is a first set position with respect to the railroad crossing apparatus 30n. FIG. 3 is a route map showing a positional relationship between the traveling train 10 and a railroad crossing apparatus 301 in a case where the railroad crossing apparatus 30n closest to the train 10 on the track R is the railroad crossing apparatus 301.

[0032] The power-ON position P1 is a point at least predetermined seconds before the train 10 reaches the railroad crossing apparatus 301, i.e., a point a distance obtained by multiplying the traveling speed of the train 10 per second by the predetermined seconds before an installation position P0 of the railroad crossing apparatus 301. That is, a distance by which the train 10 travels at a speed limit on the track R for the predetermined seconds can be employed as a distance from the installation position P0 to the power-ON position P1.

[0033] In Step ST2, in a case where the train 10 does not reach the power-ON position P1, Step ST2 is repeated. In a case where the train 10 has reached the power-ON position P1, the processing proceeds to Step ST3.

[0034] In Step ST3, the center apparatus 21 transmits power-ON command information for starting power supply to a control unit 32n, and supplies power to a railroad crossing protection device 31n in a sleep state.

[0035] In Step ST3, for the railroad crossing protection device 31n having received the control command for closing the railroad crossing apparatus 30 from the center apparatus 21 and supplied with power, the control unit 32n first starts alarming control of an alarming unit 35n outputting alarm sound and alternately blinking a pair of lamps.

[0036] In addition, the control unit 32n starts processing of an obstacle detection unit 36n detecting an obstacle in the railroad crossing. In this obstacle detection processing, for example, an image sensor can be used to detect, e.g., the presence of a pedestrian in the railroad crossing or engine stall of the vehicle in the railroad crossing.

[0037] Subsequently, after a lapse of predetermined seconds from the start of the alarming control for the alarming unit 35n, the control unit 32n starts control of a lifting-lowering unit 34n lowering a crossing gate pole 33n at the lifted position.

[0038] FIG. 4 is a route map showing a state in which a railroad crossing protection device 311 is started due to passage of the train 10 through the power-ON position P1 and a crossing gate pole 331 is lowered by a lifting-lowering unit 341.

[0039] In Step ST4, it is determined whether all first to third conditions have been satisfied, taking a condition where the alarming unit 35n is properly operated after the railroad crossing protection device 31n has been supplied with power as the first condition, a condition where lowering of the crossing gate pole 33n by the operated lifting-lowering unit 34n is properly completed as the second condition, and a condition where no obstacle is detected in the railroad crossing by the operated obstacle detection unit 36n as the third condition.

[0040] In Step ST4 in which it is determined whether the interference point S is deactivated, in a case where any of the first to third conditions is not satisfied, Step ST4 is repeated. In a case where all the first to third conditions are satisfied, the processing proceeds to Step ST5.

[0041] Step ST4 is repeated in a state in which the crossing gate pole 331 is lowered as shown in FIG. 4. After completion of lowering of the crossing gate pole 331, in a case where no obstacle is detected by the obstacle detection unit 361, Step ST4 proceeds to Step ST5. In Step ST5, the interference point S of the railroad crossing apparatus 301 is deactivated.

[0042] In addition, the center apparatus 21 transmits

interference point deactivation information for deactivating the interference point S to the train 10. The train 10 having received this interference point deactivation information deactivates the interference point S of the railroad crossing apparatus 301.

[0043] FIG. 5 is a route map in a state in which the interference point S of the railroad crossing apparatus 301 has been deactivated, and the train 10 can pass through the railroad crossing apparatus 301 in a state in which a pedestrian and a vehicle cannot cross the railroad crossing. After deactivation of the interference point S of the railroad crossing apparatus 301 in Step ST5, the processing proceeds to Step ST6.

[0044] In Step ST6, the center apparatus 21 determines whether the train 10 has passed through the railroad crossing apparatus 30n through which the train 10 is about to pass. Step ST6 is repeated until the train 10 passes through the railroad crossing apparatus 30n, and in a case where the train 10 has passed through the railroad crossing apparatus 30n, the processing proceeds to Step ST7.

[0045] In Step ST7, the center apparatus 21 transmits a control command for opening the railroad crossing apparatus 30n, and after passage of the train 10 through the railroad crossing apparatus 30n, the control unit 32n of the railroad crossing apparatus 30n stops the output of the alarming unit 35n and lifts the crossing gate pole 33n in a lowered state by the lifting-lowering unit 34n.

[0046] In addition, the center apparatus 21 transmits power-OFF command information to the control unit 32n, and the control unit 32n of the railroad crossing apparatus 30n having received this power-OFF command information brings the railroad crossing protection device 31n into a sleep state which is a non-operable state after the crossing gate pole 33n has been lifted.

[0047] FIG. 6 is a route map in a state in which the train 10 has passed through the railroad crossing apparatus 301, the crossing gate pole 331 is in the lifted state, and the railroad crossing protection device 311 is in the non-operable state. Subsequently, in Step ST8, Steps ST1 to ST8 are repeated for a railroad crossing apparatus 302 which is a next railroad crossing apparatus 30n. This processing of bringing the railroad crossing protection device 31n of the railroad crossing apparatus 30n from the non-operable state to the operable state and from the operable state to the non-operable state is repeated until the train 10 arrives at a destination.

[0048] FIG. 7 is a route map in a state in which the train 10 has reached a deceleration position P2 with the second condition not satisfied due to incompletion of lowering of the crossing gate pole 331 caused by a failure, such as motor breakdown, of the lifting-lowering unit 341.

[0049] Note that for the train 10, the power-ON position P1 indicates timing at which the power supply is turned on by the center apparatus 21 and the deceleration position P2 indicates the limit of brake control timing at which the train 10 can be stopped at the installation position P0 of the railroad crossing apparatus 301.

[0050] The state of the route map shown in FIG. 7 is a state in which an emergency state has occurred for the first to third conditions and Step ST4 is repeated, and the center apparatus 21 can grasp, via the control unit 32n, for which one of the first to third conditions the emergency state has occurred. In order to release this emergency state, the management center 20 immediately makes arrangements, for example, to dispatch a worker to the railroad crossing apparatus 30n.

[0051] In a state in which at least one of the first to third conditions is not satisfied, there is a probability that, e.g., a pedestrian or a vehicle in the railroad crossing contacts the train 10. Thus, the railroad crossing apparatus 30n is maintained as the interference point S.

[0052] As shown in FIG. 7, the deceleration position P2 is set to a point a predetermined distance dm before the railroad crossing apparatus 301, and this predetermined distance dm from the installation position P0 of the railroad crossing apparatus 301 to the deceleration position P2 is set to a distance obtained by addition of a sufficient margin to a distance required for the train 10 to stop according to a deceleration pattern.

[0053] The deceleration position P2 which is a second set position is on the railroad crossing apparatus 30 side with respect to a traveling point at which the train 10 is positioned when the shortest time required for the train 10 having passed through the power-ON position P1 to satisfy the first to third conditions lapses.

[0054] In a case where the center apparatus 21 transmits no interference point deactivation information to the train 10 because all the first to third conditions are not satisfied in Step ST4 and the train 10 has reached the deceleration position P2 without receiving the interference point deactivation information, the train 10 starts deceleration control.

[0055] Subsequently, in a case where the processing of repeating Step ST4 is continued in the center apparatus 21 because all the first to third conditions are not satisfied and the state in which the center apparatus 21 transmits no interference point deactivation information to the train 10 is continued, the train 10 eventually stops before the railroad crossing apparatus 301 in which the failure of the lifting-lowering unit 341 has occurred, as shown in FIG. 8.

[0056] Note that in many cases in the processing of repeating Step ST4, obstacle detection of the third condition is cancelled and all the first to third conditions are satisfied accordingly, for example, because a person fell down in the railroad crossing has moved by oneself.

[0057] In a case where the emergency state is released in this manner, the processing proceeds to Step ST5, and the center apparatus 21 deactivates the interference point S of the railroad crossing apparatus 30n and transmits the interference point deactivation information to the train 10. The train 10 having received this interference point deactivation information during the deceleration control deactivates the interference point S ahead, and cancels the deceleration control.

[0058] The train 10 stops before the railroad crossing apparatus 301 as shown in FIG. 8, and therefore, does not contact an obstacle in the railroad crossing or a vehicle or a pedestrian continuously crossing the railroad crossing.

[0059] Note that the first condition for the alarming unit 35n can be omitted among the first to third conditions. In this case, when both the condition where lowering of the crossing gate pole 33n has been completed and the condition where the obstacle detection unit 36n detects no obstacle after completion of lowering of the crossing gate pole 33n are satisfied, the interference point S of the railroad crossing apparatus 30n is deactivated.

[0060] This is because the train 10 can safely pass through the railroad crossing apparatus 30n when no obstacle is present in the railroad crossing in a state in which the crossing gate pole 33n is lowered. Moreover, the management center 20 immediately makes arrangements, for example, to dispatch a worker to the alarming unit 35n in which the failure has occurred.

[0061] According to the power-saving service management system, when the train 10 approaches the railroad crossing apparatus 30, the center apparatus 21 repeats the processing of temporarily powering the railroad crossing protection device 31 of the railroad crossing apparatus 30 from OFF to ON to bring the railroad crossing protection device 31 from the non-operable state to the operable state and returning the railroad crossing protection device 31 of the railroad crossing apparatus 30 to the original non-operable state after the train 10 has passed through the railroad crossing apparatus 30 in the operable state until the train 10 arrives at an arrival point P. The railroad crossing protection device 31 of the railroad crossing apparatus 30 is temporarily operated only upon passage of the train 10 so that the power consumption of the railroad crossing apparatus 30 can be reduced.

[0062] Further, in a state in which the train 10 does not approach the railroad crossing apparatus 30, the crossing gate pole 33 of the railroad crossing protection device 31 is kept lifted. Thus, a state of the crossing gate pole being lowered regardless of the position of the train 10 due to a failure as in a railroad crossing protection device using a relay control circuit in the related art is avoided. Consequently, in a state in which the train 10 does not approach the railroad crossing apparatus 30, a vehicle or a pedestrian is not limited from crossing the railroad crossing apparatus 30.

Claims

1. A power-saving service management system comprising:

a train that travels on a track;
ground equipment that is arranged on the track; and
a center apparatus that performs service management on the train and the ground equipment,
wherein the center apparatus sets first ground equipment positioned ahead of a first train and closest to the first train as an interference point interfering with passage of the first train,
when the first train reaches a first set position with a predetermined distance from the first ground equipment, the center apparatus brings the first ground equipment into an operable state in which the first ground equipment is supplied with power from a non-operable state in which the first ground equipment is supplied with no power,
the center apparatus performs processing of determining whether the interference point is to be deactivated in the operable state, and
in a case where the interference point is deactivated, the center apparatus causes the first train to pass through the first ground equipment and brings the first ground equipment into the non-operable state from the operable state after passage.

2. The power-saving service management system according to claim 1, wherein

the ground equipment is a railroad crossing apparatus including a railroad crossing protection device,
the railroad crossing protection device includes at least a lifting-lowering unit that lifts and lowers a crossing gate pole and an obstacle detection unit that detects an obstacle in a railroad crossing, and
in the determination processing by the center apparatus, the interference point is not deactivated, but maintained in a case where it is determined that at least one of a condition where the crossing gate pole lifted by the operated lifting-lowering unit is lowered or a condition where no obstacle is detected in the railroad crossing by the operated obstacle detection unit is not satisfied.

3. The power-saving service management system according to claim 2, wherein

the railroad crossing protection device further includes an alarming unit that performs alarming control, and
the conditions further include a condition where alarming by the operated alarming unit is performed, and in a case where it is determined that at least one of the conditions is not satisfied, the interference point is not deactivated, but maintained.

4. The power-saving service management system according to claim 2 or 3, wherein
after passage of the first train through the railroad crossing apparatus, the railroad crossing apparatus is brought into the non-operable state from the operable state with the crossing gate pole lifted.

5. The power-saving service management system according to claim 2 or 3, wherein

the center apparatus transmits interference point deactivation information to the first train in a case where all the conditions have been satisfied for a first railroad crossing apparatus, and
when the first train reaches a second set position with a predetermined distance from the first railroad crossing apparatus without receiving the interference point deactivation information from the center apparatus, deceleration control is started.

6. The power-saving service management system according to claim 5, wherein
the first train continues the deceleration control until receiving the interference point deactivation information from the center apparatus.

7. The power-saving service management system according to claim 5, wherein
a distance from an installation position of the railroad crossing apparatus to the second set position is greater than a distance required for the train to stop according to a deceleration pattern.

FIG. 1

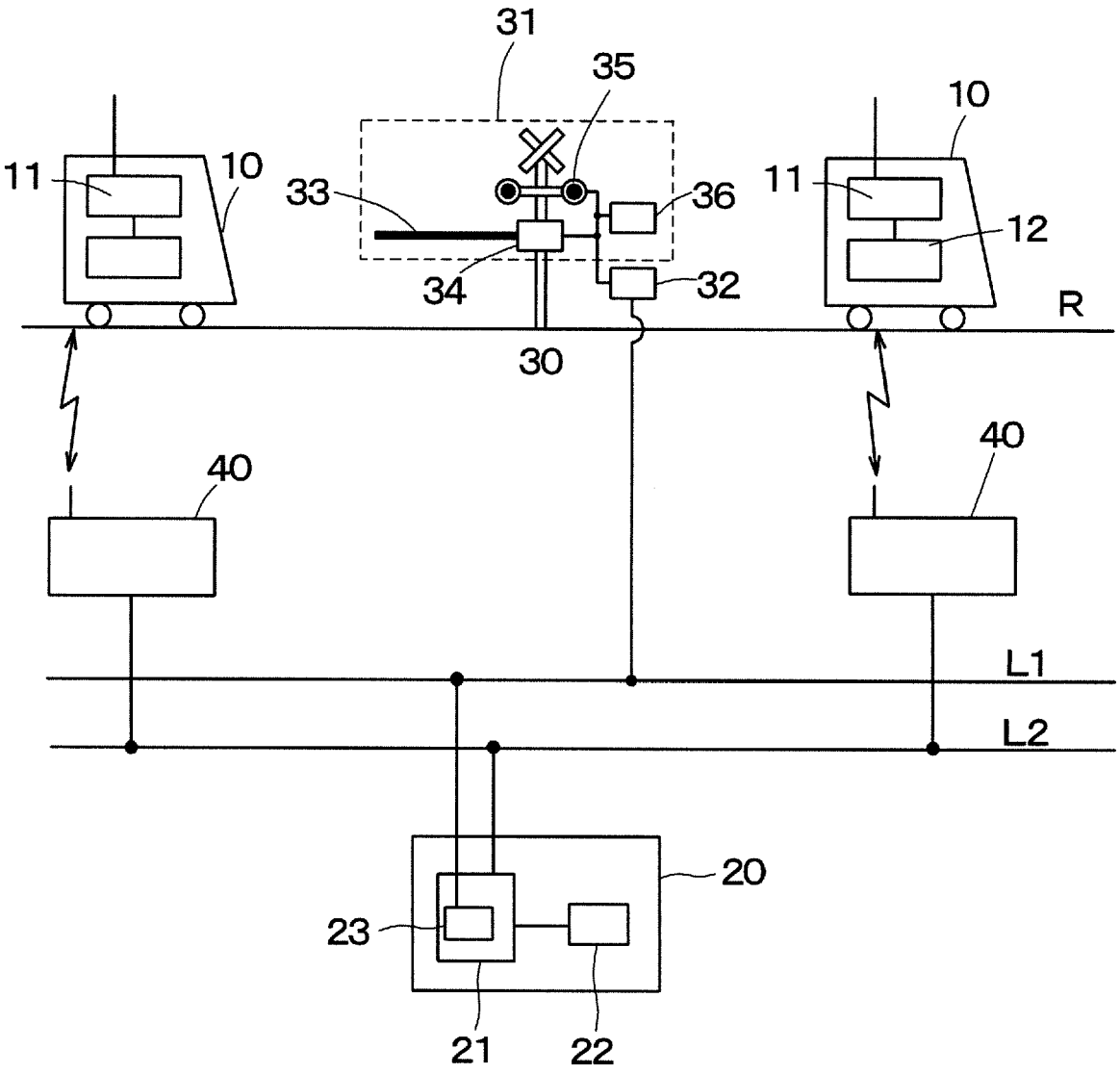


FIG. 2

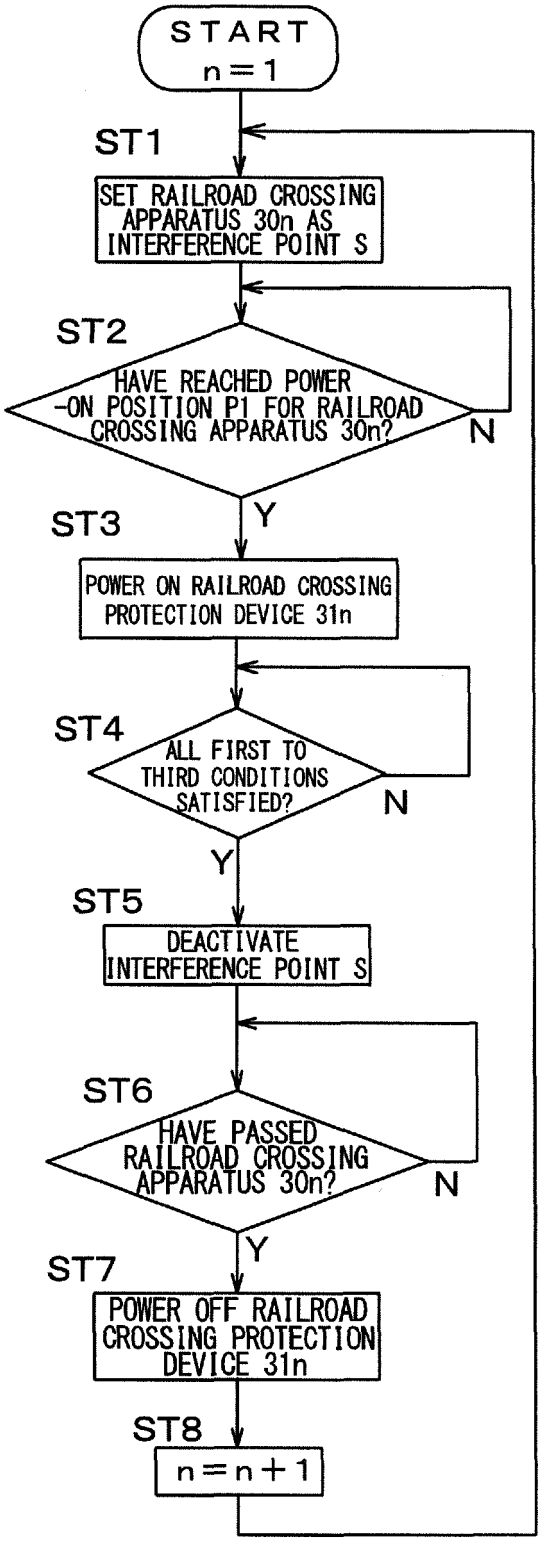

START
n=1
ST1
SET RAILROAD CROSSING APPARATUS 30n AS INTERFERENCE POINT S
ST2
HAVE REACHED POWER-ON POSITION P1 FOR RAILROAD CROSSING APPARATUS 30n?
N
Y
ST3
POWER ON RAILROAD CROSSING PROTECTION DEVICE 31n
ST4
ALL FIRST TO THIRD CONDITIONS SATISFIED?
N
Y
ST5
DEACTIVATE INTERFERENCE POINT S
ST6
HAVE PASSED RAILROAD CROSSING APPARATUS 30n?
N
Y
ST7
POWER OFF RAILROAD CROSSING PROTECTION DEVICE 31n
ST8
n=n+1

FIG. 3

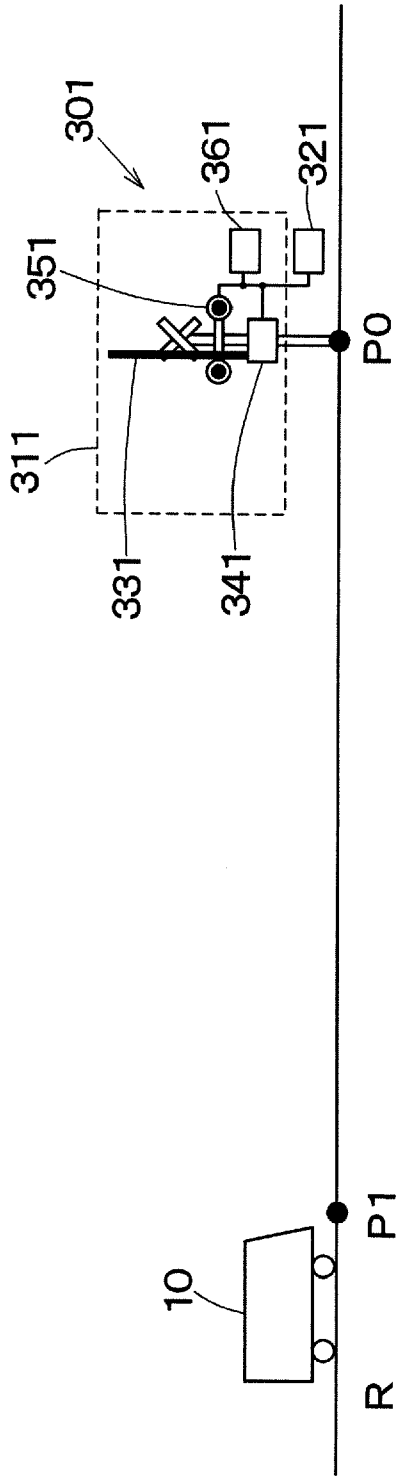
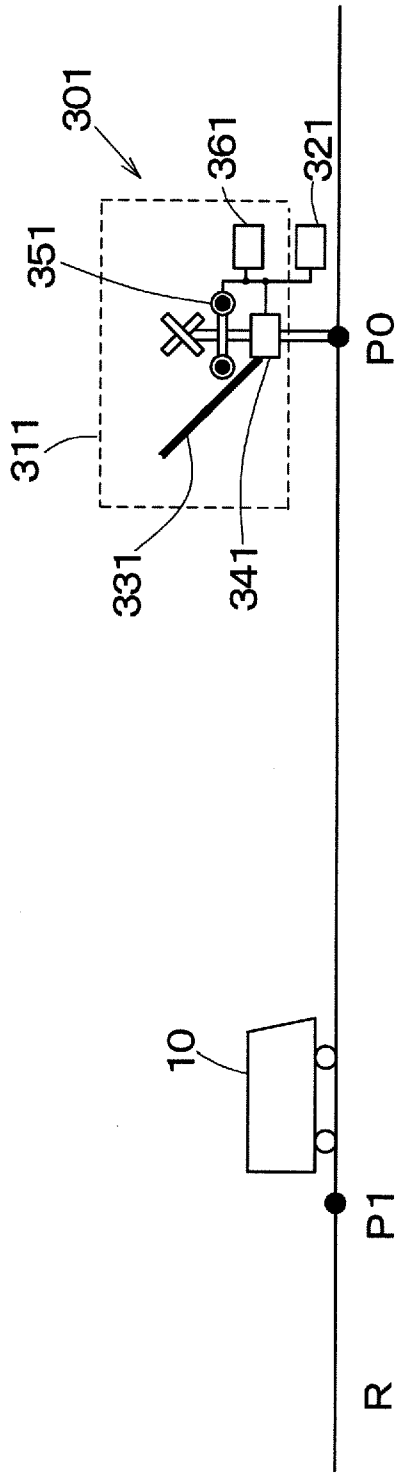

301
361
321
351
P0
311
331
341
10
P1
R

FIG. 4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341
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P1
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FIG. 5

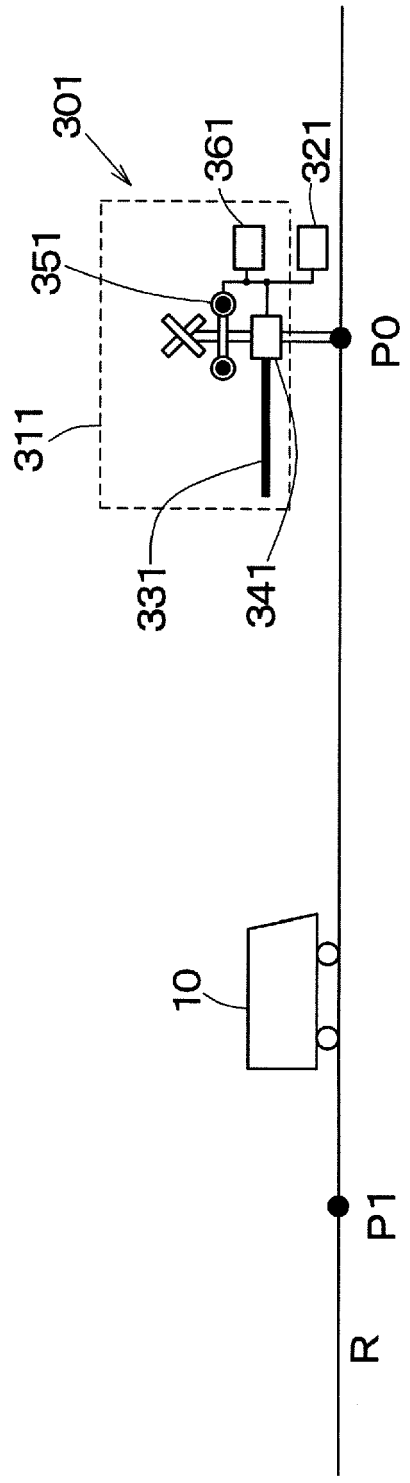
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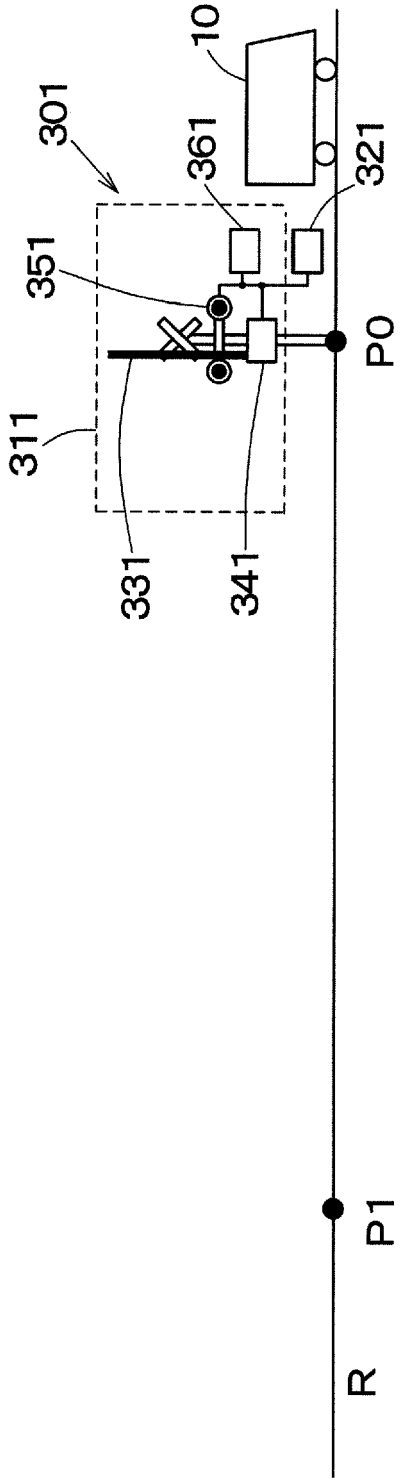
FIG. 6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P0
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P1
R

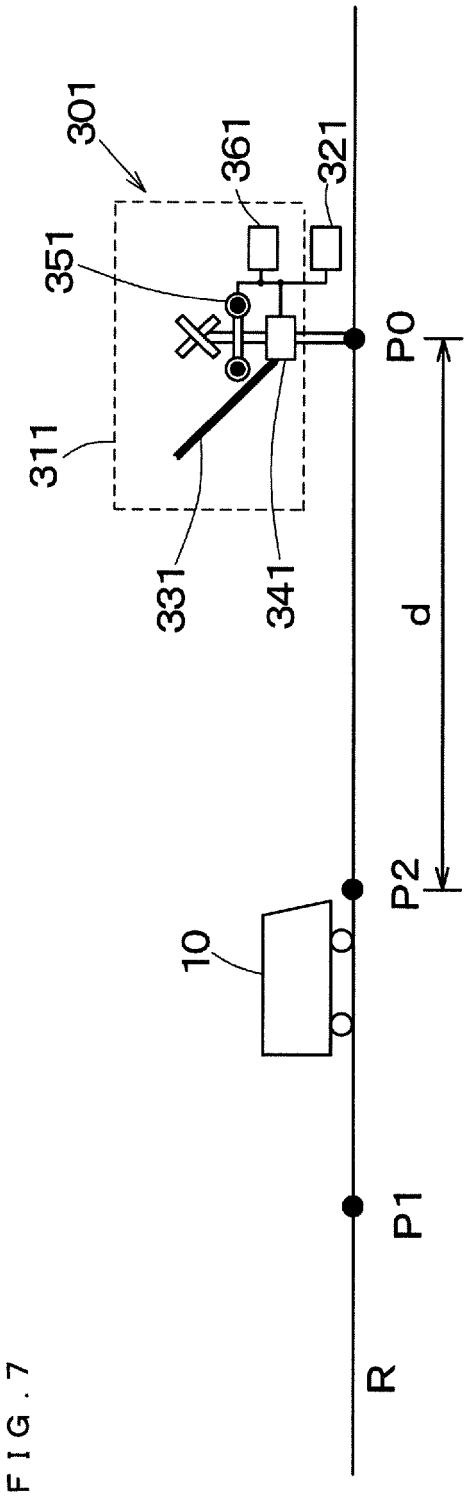
301
361
321
351
311
331
341
P0
d
P2
10
P1
R

FIG. 7

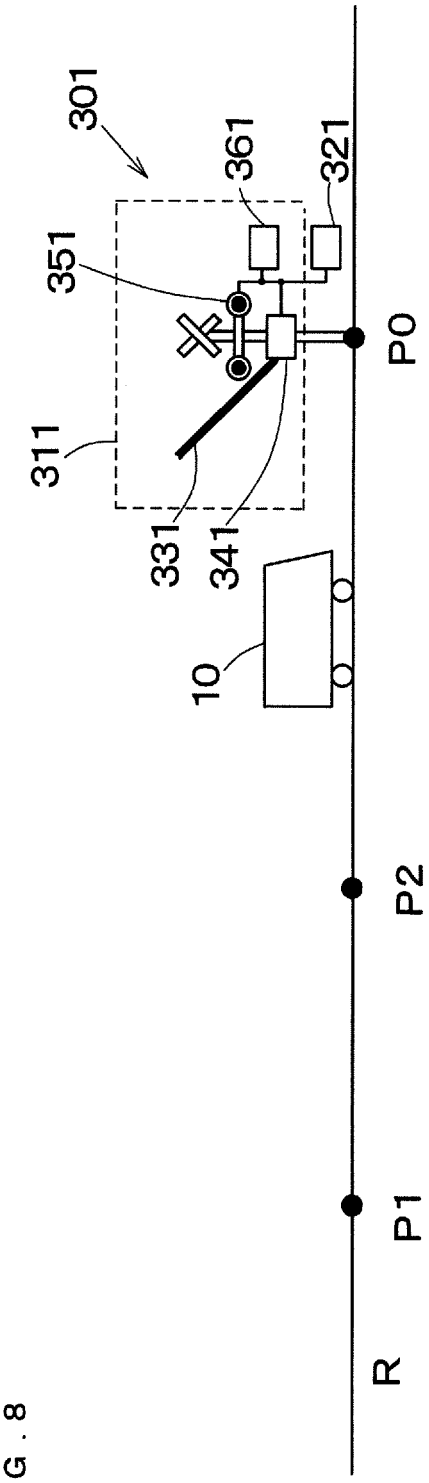
301
361
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FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 6161

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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B61L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 September 2024	Robinson, Victoria

CATEGORY OF CITED DOCUMENTS

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