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(54) METHOD AND APPARATUS FOR ROUTE UNLOCKING IN COMPUTER INTERLOCKING, AND COMPUTER STORAGE MEDIUM

VERFAHREN UND VORRICHTUNG ZUM AUFLÖSEN DER FAHRSTRASSE BEI COMPUTERSTELLWERK UND COMPUTERSPEICHERMEDIUM

PROCÉDÉ ET APPAREIL DE DÉVERROUILLAGE D'ITINÉRAIRE DANS UN ENCLANCHEMENT INFORMATIQUE, ET SUPPORT DE STOCKAGE INFORMATIQUE

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(56) References cited:

CN-A- 104 512 439 CN-A- 106 476 847
CN-A- 106 697 004 CN-A- 106 828 541
CN-A- 106 828 541

- **WILHELM SCHMITZ: "Security of Interlocking Systems for Railroad Track Switching", ELECTRICAL COMMUNICATION,, vol. 42, no. 4, 1 January 1967 (1967-01-01), pages 524-540, XP001389951,**
- **WERNER BUSCH ET AL: "Der Zentralblock ZbS 600 - Aufbau und Schaltung -", SIGNAL + DRAHT,, vol. 74, no. 12, 1 December 1982 (1982-12-01), pages 237-251, XP001390305,**

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EP 3 594 085 B1

Description

AND COMPUTER STORAGE MEDIUM

[0001] The present application claims priority of Chinese Patent Application No. 201711113006.X filed on November 13, 2017.

TECHNICAL FIELD

[0002] The present disclosure relates to a field of automatic control technologies, and to a method and apparatus for route release in Computer Interlocking (CI), and a computer storage medium.

BACKGROUND

[0003] With the rapid development of Chinese high-speed railway industry, the CTCS-2 and CTCS-3 train control systems have been practically applied to many passenger lines, which improves the automation level of train control and reduces a running interval of trains.

[0004] In order to ensure safe running of the trains and avoid accidents of the trains due to some reasons, factors such as braking distance and track are taken into full consideration; and when a train runs in a switch section of station, in order to prevent accidents of trailing, derailments and even rollover, all switches in the train running direction have to be locked at specified positions, and the switches are not allowed to rotate after being locked. In the CI process, the switches are locked in a mode of route locking section, i.e., after a route is locked, the switches in the route section are not allowed to rotate.

[0005] The length of section route locking time is closely related to the running interval of the trains, and timely release of the route section can prepare routes for following trains as soon as possible, so that the running interval can be greatly shortened. In the prior art, in order to improve station transportation efficiency, route release in CI is generally designed in a sectional release mode. When the sectional release mode is adopted, the section in the locked route should be automatically released along with normal running of the train, and the section which the train passes can be immediately provided to other trains for use, so as to improve running efficiency. However, in order to ensure driving safety, CI needs to determine by effective means whether the train normally passes through the locked section. Therefore, those skilled in the art urgently need to research and develop a method for accurately judging whether a running train normally passes through the locked section so as to maximize driving efficiency when ensuring driving safety.

SUMMARY

[0006] In view of this, the present disclosure is intended to solve the technical problem of providing a method and apparatus for route release in CI and a computer storage

medium, and solves the problem in the prior art that a train is misjudged normally passes through a locked section when some track circuits are abnormal. The invention is defined in the independent claims.

[0007] In order to solve the above-mentioned technical problem, according to the invention, the present disclosure provides a method for route release in CI, including judging whether a train normally drives into a current locked section; if a judging result is yes, judging whether the train drives away from the current locked section; if a judging result is yes, judging whether a rear section of the current locked section is released; and if a judging result is yes, releasing the current locked section.

[0008] According to the invention, the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed by a data processing device, the data processing device executes steps of: judging whether a train normally drives into a current locked section; if a judging result is yes, judging whether the train drives away from the current locked section; if a judging result is yes, judging whether a rear section of the current locked section is released; and if a judging result is yes, releasing the current locked section.

[0009] According to the invention, the present disclosure further provides an apparatus for route release in CI, including: a first judging unit, which is used for judging whether a train normally drives into a current locked section; a second judging unit, which is used for judging whether the train drives away from the current locked section when a judging result of the first judging unit is yes; a third judging unit, which is used for judging whether a rear section of the current locked section is released when a judging result of the second judging unit is yes; and a releasing unit, which is used for releasing the current locked section when a judging result of the third judging unit is yes.

[0010] According to the above features of the invention, it can be known that the method and apparatus for route release in CI and the computer storage medium at least have following advantages: it is determined whether the train normally passes through the locked section in a three-point section check mode, i.e., only when the train normally drives into the locked section and then drives away from the locked section, the locked section can be allowed to be released, thereby avoiding misjudgment when the track circuits are abnormal; and whether the train normally passes through the locked section can be accurately determined by a state of front section and states of the rear section and the current section (the current locked section), thereby maximizing driving efficiency when ensuring driving safety.

[0011] CN 106 828 541 A relates to a train operation control system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The drawings below are part of the specification

of the present disclosure, and show exemplary embodiments of the present disclosure. The drawings are used for illustrating the principle of the present disclosure together with description of the specification. Since none of the figures 1 to 10 comprises all the features of the independent claims they do not correspond to embodiments of the invention and are only intended to illustrate certain features. The scope of the invention is defined by the appended claims.

FIG. 1 is a flow chart of Embodiment I of a method for route release in CI, as provided in detailed description of the present disclosure;

FIG. 2 is a flow chart of Embodiment II of a method for route release in CI, as provided in detailed description of the present disclosure;

FIG. 3 is a flow chart of Embodiment III of a method for route release in CI, as provided in detailed description of the present disclosure;

FIG. 4 is a flow chart of Embodiment IV of a method for route release in CI, as provided in detailed description of the present disclosure;

FIG. 5 is a flow chart of Embodiment V of a method for route release in CI, as provided in detailed description of the present disclosure;

FIG. 6 is a structural schematic diagram of Embodiment I of an apparatus for route release in CI, as provided in detailed description of the present disclosure;

FIG. 7 is a structural schematic diagram of Embodiment II of an apparatus for route release in CI, as provided in detailed description of the present disclosure;

FIG. 8 is a structural schematic diagram of Embodiment III of an apparatus for route release in CI, as provided in detailed description of the present disclosure;

FIG. 9 is a structural schematic diagram of Embodiment IV of an apparatus for route release in CI, as provided in detailed description of the present disclosure; and

FIG. 10 is a structural schematic diagram of Embodiment V of an apparatus for route release in CI, as provided in detailed description of the present disclosure.

DETAILED DESCRIPTION

[0013] FIG. 1 is a flow chart of Embodiment I of a method for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 1, if a train normally drives into a current locked section and drives away from the current locked section, the current locked section is released.

[0014] In the specific embodiment shown in this drawing, the method for route release in CI includes:

S101: judging whether the train normally drives into

the current locked section. In the specific embodiment of the present disclosure, in a normal case, the train sequentially passes through a rear section, the current locked section and a front section. It is determined whether the train normally drives into the current locked section from the rear section.

S102: if a judging result is yes, judging whether the train drives away from the current locked section. In the specific embodiment of the present disclosure, if the train normally enters the current locked section, it is needed to determine whether the train drives away from the current locked section (i.e., determine whether the train drives away from the current locked section and enters the front section).

S103: if a judging result is yes, judging whether the rear section of the current locked section is released. In the specific embodiment of the present disclosure, after the rear section of the current locked section is released, the current locked section can be immediately provided to other trains for use, thereby improving running efficiency.

S104: if a judging result is yes, releasing the current locked section. In the specific embodiment of the present disclosure, if the train normally drives into the current locked section and drives away from the current locked section, after the rear section of the current locked section is released, the current locked section is released.

[0015] With reference to FIG. 1, only when the train normally passes through the current locked section and the rear section of the current locked section is released, the current locked section can be released, thereby implementing automatic release of the locked section, preventing misjudgment caused by abnormality of track circuits and maximizing running efficiency when ensuring driving safety.

[0016] FIG. 2 is a flow chart of Embodiment II of a method for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 2, if the train does not normally drive into the current locked section or the train does not normally drive away from the current locked section, the current locked section is kept in a locked state.

[0017] In the specific embodiment shown in this drawing, after the step S104, the method for route release in CI further includes:

S105: if the judging result is no, keeping the current locked section in the locked state. In the specific embodiment of the present disclosure, if the train does not normally drive into the current locked section or the train does not normally drive away from the current locked section, the current locked section still cannot be released so as to avoid driving danger.

[0018] With reference to FIG. 2, in order to ensure driving safety of the train, only when the train normally passes through the current locked section and the rear section of the current locked section is released, the current

locked section can be released.

[0019] FIG. 3 is a flow chart of Embodiment III of a method for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 3, only when a state of the rear section is turned into an idle state from an occupied state and the state of the current locked section is turned into an occupied state from an idle state, it can be determined that the train normally drives into the current locked section.

[0020] In the specific embodiment shown in this drawing, the step S101 particularly includes:

S1011: judging whether the current locked section is turned into the occupied state from the idle state. In the specific embodiment of the present disclosure, the states of the current locked section includes the idle state and the occupied state, and when the state of the current locked section is turned into the occupied state from the idle state, it shows that a train head has driven into the current locked section.

S1012: if a judging result is yes, judging whether the rear section is turned into the idle state from the occupied state. In the specific embodiment of the present disclosure, if the current locked section is a signal first internal section, the rear section is also called as a route approaching section or a signal external section. The state of the rear section includes the idle state and the occupied state, and when the rear section is turned into the idle state from the occupied state, it shows that a train rear end has driven away from the rear section, i.e., the train completely enters the current locked section.

[0021] In the step S1012, if the judging result is yes, it is determined that the train normally drives into the current locked section. In the specific embodiment of the present disclosure, only when the current locked section is turned into the occupied state from the idle state and the rear section is turned into the idle state from the occupied state, it can be determined that the train completely drives into the current locked section.

[0022] With reference to FIG. 3, when the current locked section is turned into the occupied state from the idle state and the rear section is turned into the idle state from the occupied state, it is accurately determined that the train completely drives into the current locked section and misjudgment cannot occur.

[0023] FIG. 4 is a flow chart of Embodiment IV of a method for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 4, only when a state of the front section is turned into an occupied state from an idle state and the state of the current locked section is turned into the idle state from the occupied state, it can be determined that the train normally drives away from the current locked section.

[0024] In the specific embodiment shown in this drawing, the step S102 particularly includes:

S1021: judging whether the front section is turned into the occupied state from the idle state. In the specific embodiment of the present disclosure, the state of the front section includes the idle state and the occupied state; and when the state of the front section is turned into the occupied state from the idle state, it shows that the train has driven into the front section.

S1022: if a judging result is yes, judging whether the current locked section is turned into the idle state from the occupied state. In the specific embodiment of the present disclosure, when the state of the current locked section is turned into the idle state from the occupied state, it shows that the train rear end has driven away from the current locked section.

[0025] In the step S1022, if the judging result is yes, it is determined that the train normally drives away from the current locked section. In the specific embodiment of the present disclosure, only when the front section is turned into the occupied state from the idle state and the current locked section is turned into the idle state from the occupied state, it can be determined that the train normally drives away from the current locked section.

[0026] With reference to FIG. 4, only when the front section is turned into the occupied state from the idle state and the current locked section is turned into the idle state from the occupied state, it can be determined that the train normally drives away from the current locked section, thereby accurately determining that the train normally drives away from the current locked section and ensuring driving safety.

[0027] FIG. 5 is a flow chart of Embodiment V of a method for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 5, after the rear section of the current locked section is released, the current locked section can be immediately provided to other trains for use, thereby improving running efficiency.

[0028] In the specific embodiment shown in this drawing, the step S103 particularly includes:

S1031: judging whether the rear section is released. In the specific embodiment of the present disclosure, only after the rear section is released, other trains are allowed to use the current locked section, i.e., the current locked section is released.

S1032: if a judging result is yes, notifying a releasing unit to release the current locked section. In the specific embodiment of the present disclosure, after the rear section is released, the current locked section is released.

[0029] With reference to FIG. 5, after the rear section of the current locked section is released, the current locked section can be immediately provided for other trains for use, and a route can be prepared for following trains as soon as possible, thereby improving running

efficiency.

[0030] A specific embodiment of the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed via a data processing device, the data processing device executes steps of:

S101: judging whether a train normally drives into a current locked section.

S102: if a judging result is yes, judging whether the train drives away from the current locked section.

S103: if a judging result is yes, judging whether a rear section of the current locked section is released.

S104: if a judging result is yes, releasing the current locked section.

[0031] A specific embodiment of the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed by the data processing device, the data processing device executes steps of:

S101: judging whether the train normally drives into the current locked section.

S102: if the judging result is yes, judging whether the train drives away from the current locked section.

S103: if the judging result is yes, judging whether the rear section of the current locked section is released.

S104: if the judging result is yes, releasing the current locked section.

S105: if the judging result is no, keeping the current locked section in a locked state.

[0032] A specific embodiment of the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed by the data processing device, the data processing device executes steps of:

S1011: judging whether the current locked section is turned into an occupied state from an idle state.

S1012: if a judging result is yes, judging whether the rear section is turned into an idle state from an occupied state.

S102: if a judging result is yes, judging whether the train drives away from the current locked section.

S103: if the judging result is yes, judging whether the rear section of the current locked section is released.

S104: if the judging result is yes, releasing the current locked section.

S105: or, keeping the current locked section in the

locked state.

[0033] A specific embodiment of the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed by the data processing device, the data processing device executes steps of:

S101: judging whether the train normally drives into the current locked section.

S1021: judging whether a front section is turned into an occupied state from an idle state.

S1022: if a judging result is yes, judging whether the current locked section is turned into the idle state from the occupied state.

S103: if a judging result is yes, judging whether the rear section of the current locked section is released.

S104: if determining that the train normally drives away from the current locked section, releasing the current locked section.

S105: or, keeping the current locked section in the locked state.

[0034] A specific embodiment of the present disclosure further provides a computer storage medium including a computer executing instruction. When the computer executing instruction is processed by the data processing device, the data processing device executes steps of:

S101: judging whether the train normally drives into the current locked section.

S102: if the judging result is yes, judging whether the train drives away from the current locked section.

S1031: if the judging result is yes, judging whether the rear section is released.

S1032: if a judging result is yes, notifying a releasing unit to release the current locked section.

S104: if a judging result is yes, releasing the current locked section.

S105: if the judging result is no, keeping the current locked section in the locked state.

[0035] FIG. 6 is a structural schematic diagram of Embodiment I of an apparatus for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 6, the apparatus can be applied to the methods shown in FIG. 1 to FIG. 5, and if a train normally drives into a current locked section and drives away from the current locked section, the current locked section is released.

[0036] In the specific embodiment shown in this drawing, the apparatus for route release in CI includes: a first judging unit 1, a second judging unit 2, a third judging unit 3 and a releasing unit 4, wherein the first judging unit 1 is used for judging whether the train normally drives into the current locked section; the second judging unit 2 is used for judging whether the train drives away from the current locked section when a judging result of the

first judging unit 1 is yes; the third judging unit 3 is used for judging whether a rear section of the current locked section is released when a judging result of the second judging unit 2 is yes; and the releasing unit 4 is used for releasing the current locked section when a judging result of the third judging unit 3 is yes.

[0037] With reference to FIG. 6, only when the train normally passes through the current locked section and the rear section of the current locked section is released, the current locked section can be released, thereby implementing automatic release of the locked section, preventing misjudgment caused by abnormality of track circuits and maximizing running efficiency when ensuring driving safety.

[0038] FIG. 7 is a structural schematic diagram of Embodiment II of an apparatus for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 7, if the train does not normally drive into the current locked section or the train does not normally drive away from the current locked section, the current locked section is kept in a locked state.

[0039] In the specific embodiment shown in this drawing, the apparatus for route release in CI further includes: a keeping unit 5, wherein the keeping unit 5 is used for keeping the current locked section in the locked state when the judging result of at least one of the first judging unit 1, the second judging unit 2 and the third judging unit 3 is no.

[0040] With reference to FIG. 7, in order to ensure driving safety of the train, only after the train normally passes through the current locked section and the rear section of the current locked section is released, the current locked section can be released and other trains are allowed to use the released section.

[0041] FIG. 8 a structural schematic diagram of Embodiment III of an apparatus for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 8, only when a state of the rear section is turned into an idle state from an occupied state and a state of the current locked section is turned into an occupied state from an idle state, it is determined that the train normally drives into the current locked section.

[0042] In the specific embodiment shown in this drawing, the first judging unit 1 particularly includes: a first judging module 11, a second judging module 12 and a determining module 13, wherein the first judging module 11 is used for judging whether the current locked section is turned into the occupied state from the idle state; the second judging module 12 is used for judging whether the rear section is turned into the idle state from the occupied state when a judging result of the first judging module is yes; and the determining module 13 is used for determining that the train normally drives into the current locked section when a judging result of the second judging module 12 is yes.

[0043] With reference to FIG. 8, when the current locked section is turned into the occupied state from the idle state and the rear section is turned into the idle state

from the occupied state, it is accurately determined that the train completely drives into the current locked section and misjudgment cannot occur.

[0044] FIG. 9 is a structural schematic diagram of Embodiment IV of an apparatus for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 9, only when a state of a front section is turned into an occupied state from an idle state and the state of the current locked section is turned into the idle state from the occupied state, it is determined that the train normally drives away from the current locked section.

[0045] In the specific embodiment shown in this drawing, the second judging unit 2 particularly includes: a first judging module 21, a second judging module 22 and a determining module 23, wherein the first judging module 21 is used for judging whether the front section is turned into the occupied state from the idle state; the second judging module 22 is used for judging whether the current locked section is turned into the idle state from the occupied state when a judging result of the first judging module 21 is yes; and the determining module 23 is used for determining that the train normally drives away from the current locked section when a judging result of the second judging module 22 is yes.

[0046] With reference to FIG. 9, only when the front section is turned into the occupied state from the idle state and the current locked section is turned into the idle state from the occupied state, it is determined that the train normally drives away from the current locked section, thereby accurately determining that the train normally drives away from the current locked section, avoiding misjudgment caused by abnormality of track circuits and ensuring driving safety.

[0047] FIG. 10 is a structural schematic diagram of Embodiment V of an apparatus for route release in CI, as provided in detailed description of the present disclosure. As shown in FIG. 10, after the rear section of the current locked section is released, the current locked section can be immediately provided to other trains for use, thereby improving running efficiency.

[0048] In the specific embodiments shown in this drawing, the third judging unit 3 particularly includes: a judging module 31 and a notifying module 32, wherein the judging module 31 is used for judging whether the rear section is released; and the notifying module 32 is used for notifying the releasing unit to release the current locked section if a judging result of the judging module is yes.

[0049] With reference to FIG. 10, after the rear section of the current locked section is released, the current locked section can be immediately provided to other trains for use and a route can be prepared for the following trains as soon as possible, thereby improving running efficiency.

[0050] The specific embodiments of the present disclosure provide the method and apparatus for route release in CI, and the computer storage medium. Whether the train normally passes through the locked section is

detected and determined in a three-point section check mode, i.e., only when the train normally drives into the current locked section and normally drives away from the current locked section, the current locked section can be allowed to be released, thereby avoiding misjudgment caused when the track circuits are abnormal; and whether the train normally passes through the locked section can be accurately determined by the state of the front section and the states of the rear section and the current section (the current locked section), thereby maximizing running efficiency when ensuring driving safety.

[0051] The above-mentioned embodiments of the present disclosure can be implemented in various hardware, software coding or combination thereof. For example, the embodiments of the present disclosure also can be program codes for executing the above-mentioned method in a Digital Signal Processor (DSP). The present disclosure also can relate to various functions executed by a computer processor, the DSP, a microprocessor or a Field Programmable Gate Array (FPGA). The above-mentioned processors can be configured according to the present disclosure to execute specific tasks, and complete by executing machine readable software codes or firmware codes defining the specific method disclosed by the present disclosure. The software codes or the firmware codes can be developed into different program languages or different formats or forms. The software codes or the firmware codes also can be different target platform compiled software codes.

Claims

- 1. A method for releasing a route in computer interlocking, comprising:

judging (101), in a first step, whether a train normally drives into a current locked section;
 if a result of the first step is yes, judging (102), in a second step, whether the train drives away from the current locked section;
 if a result of the second step is yes, judging (103), in a third step, whether a rear section of the current locked section is released; and
 if a result of the third step is yes, releasing (104), in a fourth step, the current locked section, wherein if any of the judging results of the first, the second, and the third steps are no, keeping (105) the current locked section in a locked state,
 wherein the step of judging (101) whether the train normally drives into the current locked section includes:

judging (1011), in a fifth step, whether the current locked section is turned into an occupied state from an idle state;
 if a judging result of the fifth step is yes, judg-

ing (1012), in a sixth step, whether the rear section is turned into an idle state from an occupied state; and
 if a judging result of the sixth step is yes, determining that the train normally drives into the current locked section,
 wherein the step of judging (102) whether the train drives away from the current locked section includes:

judging (1021), in a seventh step, whether a front section is turned into the occupied state from the idle state;
 if a judging result of the seventh step is yes, judging (1022), in an eighth step, whether the current locked section is turned into the idle state from the occupied state; and
 if a judging result of the eighth step is yes, determining that the train normally drives away from the current locked section.

- 2. A computer storage medium comprising a computer executing instruction, wherein when the computer executing instruction is processed via a data processing device, the data processing device executes the method according to claim 1.
- 3. An apparatus for route release in computer interlocking, comprising:

a first judging unit (1), which is configured to judge whether a train normally drives into a current locked section;
 a second judging unit (2), which is configured to judge whether the train drives away from the current locked section when a judging result of the first judging unit is yes;
 a third judging unit (3), which is configured to judge whether a rear section of the current locked section is released when a judging result of the second judging unit is yes;
 a releasing unit (4), which is configured to release the current locked section when a judging result of the third judging unit is yes, and
 a keeping unit (5), which is configured to keep the current locked section in a locked state when the judging result of the first judging unit (1) or/and the second judging unit (2) or/and the judging result of the third judging unit (3) is no, wherein the first judging unit (1) includes:

a first judging module (11), which is configured to judge whether the current locked section is turned into an occupied state from an idle state;
 a second judging module (12), which is con-

figured to judge whether the rear section is turned into the idle state from the occupied state when a judging result of the first judging module (11) is yes; and
 a determining module (13), which is configured to determine that the train normally drives into the current locked section when a judging result of the second judging module (12) is yes,
 wherein the second judging unit (2) includes:

a first judging module (21), which is configured to judge whether a front section is turned into the occupied state from the idle state;
 a second judging module (22), which is configured to judge whether the current locked section is turned into the idle state when a judging result of the first judging module (21) is yes; and
 a determining module (23), which is configured to determine that the train normally drives away from the current locked section when a judging result of the second judging module (22) is yes, wherein the third judging unit (3) includes:
 a notifying module (32), which is configured to notify the releasing unit (4) to release the current locked section if a judging result of the judging module is yes.

Patentansprüche

1. Verfahren zum Freigeben einer Fahrstraße im Computerstellwerk, umfassend:

Beurteilen (101) in einem ersten Schritt, ob ein Zug normalerweise in einen aktuell gesperrten Abschnitt einfährt;
 wenn das Ergebnis des ersten Schritts ja ist, Beurteilen (102) in einem zweiten Schritt, ob der Zug aus dem aktuell gesperrten Abschnitt herausfährt;
 wenn ein Ergebnis des zweiten Schritts ja ist, Beurteilen (103) in einem dritten Schritt, ob ein hinterer Abschnitt des aktuell gesperrten Abschnitts freigegeben ist; und
 wenn das Ergebnis des dritten Schritts ja ist, Freigeben (104) in einem vierten Schritt des aktuell gesperrten Abschnitts,
 wobei, wenn eines der Beurteilungsergebnisse des ersten, des zweiten und des dritten Schritts nein sind, Halten (105) des aktuell gesperrten

Abschnitts in einem gesperrten Zustand, wobei der Schritt des Beurteilens (101), ob der Zug normalerweise in den aktuell gesperrten Abschnitt fährt, umfasst:

Beurteilen (1011) in einem fünften Schritt, ob der aktuell gesperrte Abschnitt von einem Leerzustand in einen Belegt-Zustand überführt wird;
 wenn ein Beurteilungsergebnis des fünften Schritts ja ist, Beurteilen (1012) in einem sechsten Schritt, ob der hintere Abschnitt von einem Belegt-Zustand in einen Leerzustand umgeschaltet wird; und
 wenn das Ergebnis des sechsten Schritts ja lautet, Bestimmen, dass der Zug normalerweise in den aktuell gesperrten Abschnitt einfährt,
 wobei der Schritt des Beurteilens (102), ob der Zug von dem aktuellen gesperrten Abschnitt wegfährt, umfasst:

Beurteilen (1021) in einem siebten Schritt, ob ein vorderer Abschnitt aus dem Leerzustand in den Belegt-Zustand gewechselt ist;
 wenn ein Beurteilungsergebnis des siebten Schritts ja ist, Beurteilen (1022) in einem achten Schritt, ob der aktuell gesperrte Abschnitt aus dem Belegt-Zustand in den Leerzustand übergeht; und
 wenn das Ergebnis des achten Schritts ja lautet, Bestimmen, dass der Zug normalerweise von dem aktuell gesperrten Abschnitt wegfährt.

2. Computerspeichermedium mit einem Computerausführungsbefehl, wobei, wenn der Computerausführungsbefehl über eine Datenverarbeitungsvorrichtung verarbeitet wird, die Datenverarbeitungsvorrichtung das Verfahren nach Anspruch 1 ausführt.

3. Vorrichtung zum Freigeben einer Fahrstraße im Computerstellwerk, umfassend:

eine erste Beurteilungseinheit (1), die so konfiguriert ist, dass sie beurteilt, ob ein Zug normalerweise in einen aktuell gesperrten Abschnitt einfährt;
 eine zweite Beurteilungseinheit (2), die so konfiguriert ist, dass sie beurteilt, ob der Zug von dem aktuell gesperrten Abschnitt wegfährt, wenn ein Beurteilungsergebnis der ersten Beurteilungseinheit ja ist;
 eine dritte Beurteilungseinheit (3), die so konfiguriert ist, dass sie beurteilt, ob ein hinterer Abschnitt des aktuell gesperrten Abschnitts freige-

geben ist, wenn ein Beurteilungsergebnis der zweiten Beurteilungseinheit ja ist; eine Freigabeeinheit (4), die so konfiguriert ist, dass sie den aktuell gesperrten Abschnitt freigibt, wenn ein Beurteilungsergebnis der dritten Beurteilungseinheit positiv ist, und eine Halteeinheit (5), die so konfiguriert ist, dass sie den aktuell gesperrten Abschnitt in einem gesperrten Zustand hält, wenn das Beurteilungsergebnis der ersten Beurteilungseinheit (1) oder/und der zweiten Beurteilungseinheit (2) oder/und das Beurteilungsergebnis der dritten Beurteilungseinheit (3) nein ist, wobei die erste Beurteilungseinheit (1) umfasst:

ein erstes Beurteilungsmodul (11), das so konfiguriert ist, dass es beurteilt, ob der aktuell gesperrte Abschnitt von einem Leerzustand in einen Belegt-Zustand übergeht; ein zweites Beurteilungsmodul (12), das so konfiguriert ist, dass es beurteilt, ob der hintere Abschnitt vom Belegt-Zustand in den Leerzustand übergeht, wenn ein Beurteilungsergebnis des ersten Beurteilungsmoduls (11) "ja" ist; und ein Bestimmungsmodul (13), das so konfiguriert ist, dass es bestimmt, dass der Zug normalerweise in den aktuell gesperrten Abschnitt einfährt, wenn ein Beurteilungsergebnis des zweiten Beurteilungsmoduls (12) ja ist, wobei die zweite Beurteilungseinheit (2) umfasst:

ein erstes Beurteilungsmodul (21), das so konfiguriert ist, dass es beurteilt, ob ein vorderer Abschnitt vom Leerzustand in den Belegt-Zustand übergeht; ein zweites Beurteilungsmodul (22), das so konfiguriert ist, dass es beurteilt, ob der aktuell gesperrte Abschnitt vom Belegt-Zustand in den Leerzustand übergeht, wenn ein Beurteilungsergebnis des ersten Beurteilungsmoduls (21) ja ist; und ein Bestimmungsmodul (23), das so konfiguriert ist, dass es bestimmt, dass der Zug normalerweise von dem aktuell gesperrten Abschnitt wegfährt, wenn ein Beurteilungsergebnis des zweiten Beurteilungsmoduls (22) ja ist, wobei die dritte Beurteilungseinheit (3) umfasst: ein Meldemodul (32), das so konfiguriert ist, um der Freigabeeinheit (4) mitzuteilen, dass der aktuell gesperrte Abschnitt freigegeben werden soll, wenn ein Beurteilungsergebnis des Beurtei-

lungsmoduls ja lautet.

Revendications

1. Procédé pour la libération d'une route dans une imbrication d'ordinateurs, comprenant :

l'estimation (101), lors d'une première étape, de si un train circule normalement en entrant dans une section verrouillée actuelle ; si un résultat de la première étape est oui, l'estimation (102), lors d'une deuxième étape, de si le train circule en s'éloignant de la section verrouillée actuelle ; si un résultat de la deuxième étape est oui, l'estimation (103), lors d'une troisième étape, de si une section arrière de la section verrouillée actuelle est libérée ; et si un résultat de la troisième étape est oui, la libération (104), lors d'une quatrième étape, de la section verrouillée actuelle, dans lequel si l'un quelconque des résultats d'estimation des première, deuxième et troisième étapes est non, le maintien (105) de la section verrouillée actuelle dans un état verrouillé, dans lequel l'étape d'estimation (101) de si le train circule normalement en entrant dans la section verrouillée actuelle inclut :

l'estimation (1011), lors d'une cinquième étape, de si la section verrouillée actuelle passe dans un état occupé à partir d'un état inactif ;

si un résultat d'estimation de la cinquième étape est oui, l'estimation (1012), lors d'une sixième étape, de si la section arrière passe dans un état inactif à partir d'un état occupé ; et

si un résultat d'estimation de la sixième étape est oui, la détermination que le train circule normalement en entrant dans la section verrouillée actuelle, dans lequel l'étape d'estimation (102) de si le train circule en s'éloignant de la section verrouillée actuelle inclut :

l'estimation (1021), lors d'une septième étape, de si une section avant passe dans l'état occupé à partir de l'état inactif ;

si un résultat d'estimation de la septième étape est oui, l'estimation (1022), lors d'une huitième étape, de si la section verrouillée actuelle passe dans l'état inactif à partir de l'état occupé ; et si un résultat d'estimation de la huitième étape est oui, la détermination que

le train circule normalement en s'éloignant de la section verrouillée actuelle.

2. Support de stockage d'ordinateur comprenant une instruction d'exécution d'ordinateur, dans lequel lorsque l'instruction d'exécution d'ordinateur est traitée via un dispositif de traitement de données, le dispositif de traitement de données exécute le procédé selon la revendication 1. 5
3. Appareil pour une libération de route dans une imbrication d'ordinateurs, comprenant : 10

une première unité d'estimation (1), qui est configurée pour estimer si un train circule normalement en entrant dans une section verrouillée actuelle ; 15

une deuxième unité d'estimation (2), qui est configurée pour estimer si le train circule en s'éloignant de la section verrouillée actuelle lorsqu'un résultat d'estimation de la première unité d'estimation est oui ; 20

une troisième unité d'estimation (3), qui est configurée pour estimer si une section arrière de la section verrouillée actuelle est libérée lorsqu'un résultat d'estimation de la deuxième unité d'estimation est oui ; 25

une unité de libération (4), qui est configurée pour libérer la section verrouillée actuelle lorsqu'un résultat d'estimation de la troisième unité d'estimation est oui, et 30

une unité de maintien (5), qui est configurée pour maintenir la section verrouillée actuelle dans un état verrouillé lorsque le résultat d'estimation de la première unité d'estimation (1) ou/et de la deuxième unité d'estimation (2) ou/et le résultat d'estimation de la troisième unité d'estimation (3) est non, 35
dans lequel la première unité d'estimation (1) comporte : 40

un premier module d'estimation (11), qui est configuré pour estimer si la section verrouillée actuelle passe dans un état occupé à partir d'un état inactif ; 45

un second module d'estimation (12), qui est configuré pour estimer si la section arrière passe dans l'état inactif à partir de l'état occupé lorsqu'un résultat d'estimation du premier module d'estimation (11) est oui ; et 50

un module de détermination (13), qui est configuré pour déterminer que le train circule normalement en entrant dans la section verrouillée actuelle lorsqu'un résultat d'estimation du second module d'estimation (12) est oui, 55
dans lequel la deuxième unité d'estimation (2) inclut :

un premier module d'estimation (21), qui est configuré pour estimer si une section avant passe dans l'état occupé à partir de l'état inactif ;

un second module d'estimation (22), qui est configuré pour estimer si la section verrouillée actuelle passe dans l'état inactif à partir de l'état occupé lorsqu'un résultat d'estimation du premier module d'estimation (21) est oui ; et

un module de détermination (23), qui est configuré pour déterminer que le train circule normalement en s'éloignant de la section verrouillée actuelle lorsqu'un résultat d'estimation du second module d'estimation (22) est oui, dans lequel la troisième unité d'estimation (3) inclut :

un module de notification (32), qui est configuré pour notifier l'unité de libération (4) de libérer la section verrouillée actuelle si un résultat d'estimation du module d'estimation est oui.

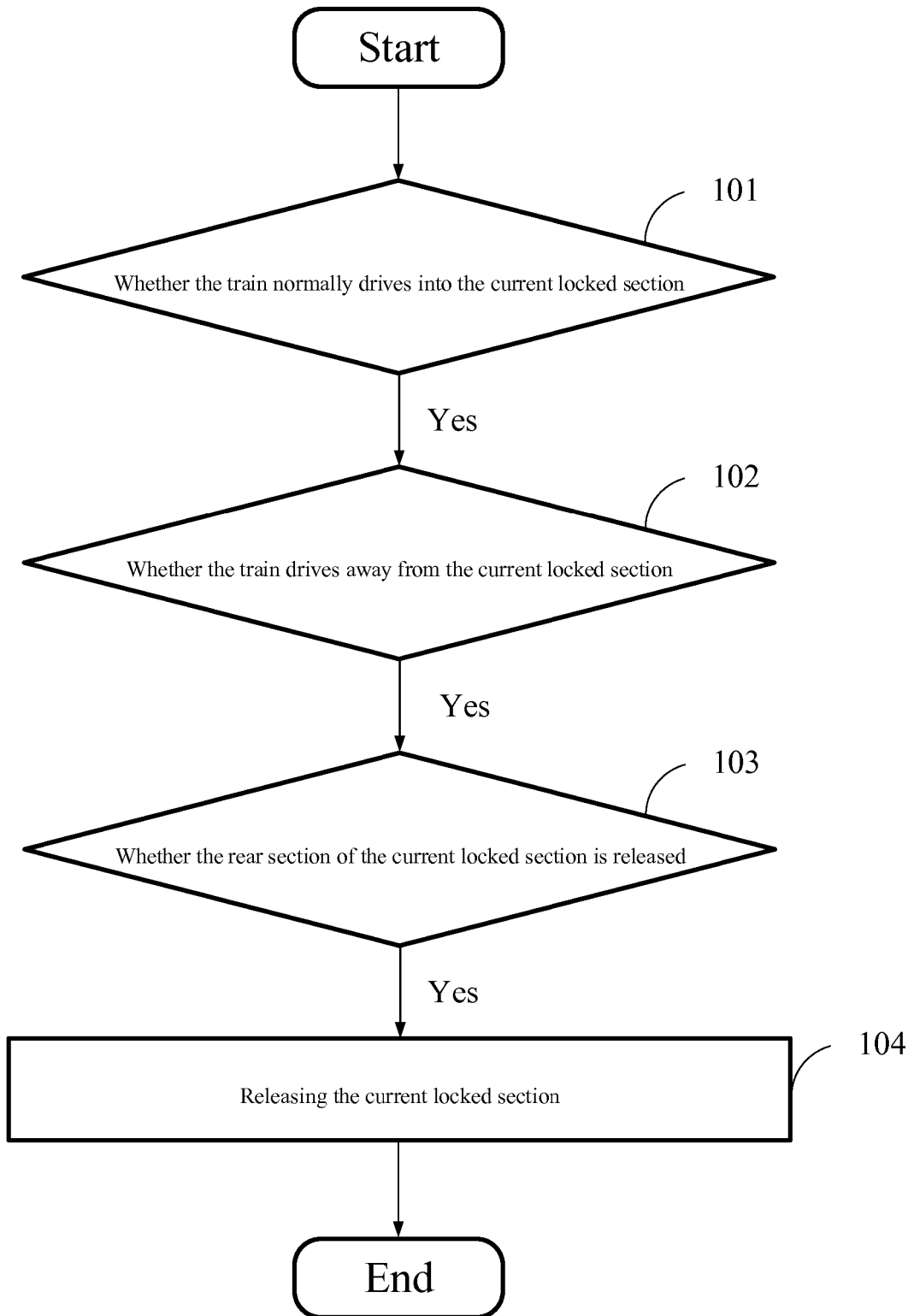


FIG. 1

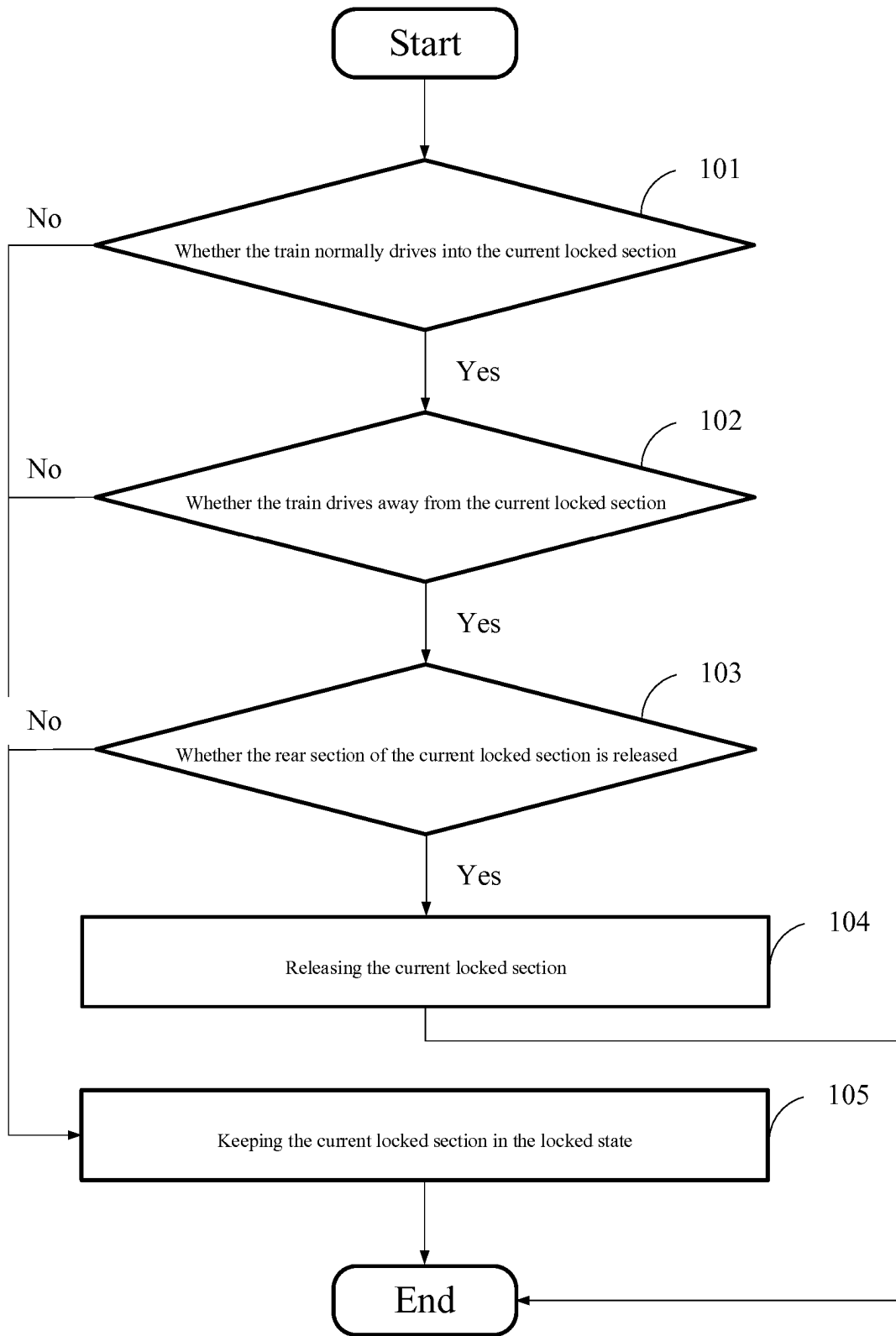


FIG. 2

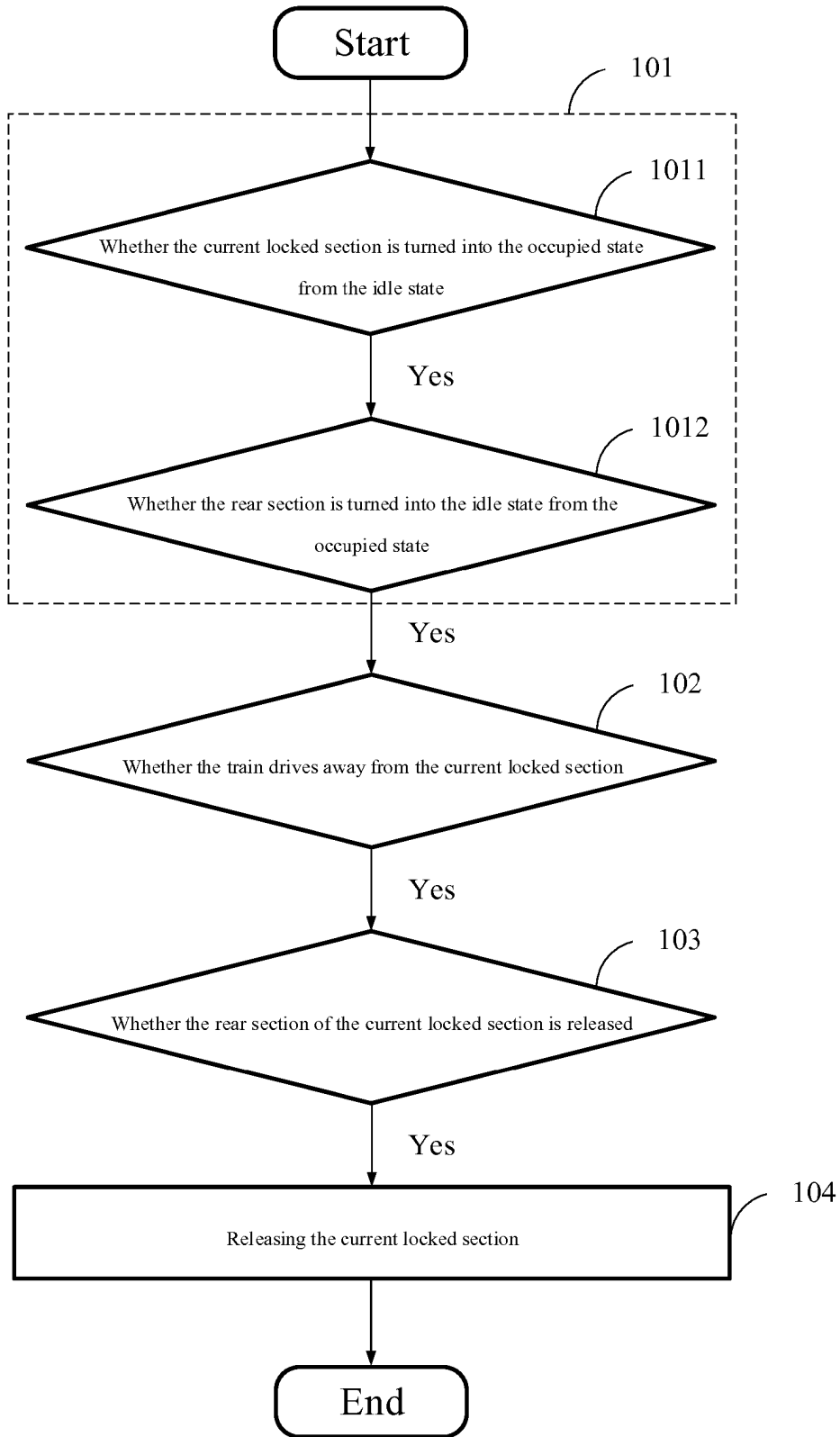


FIG. 3

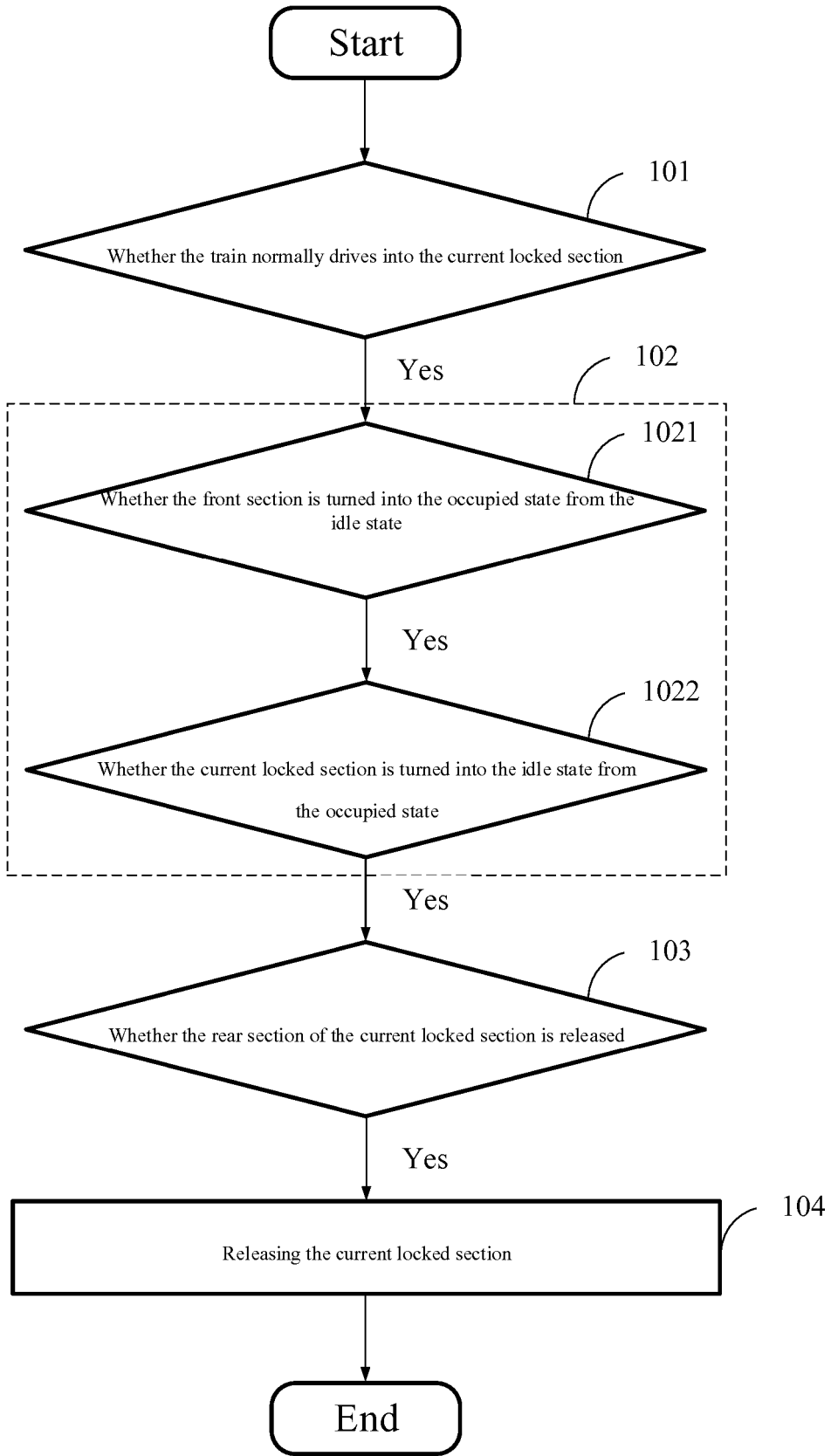


FIG. 4

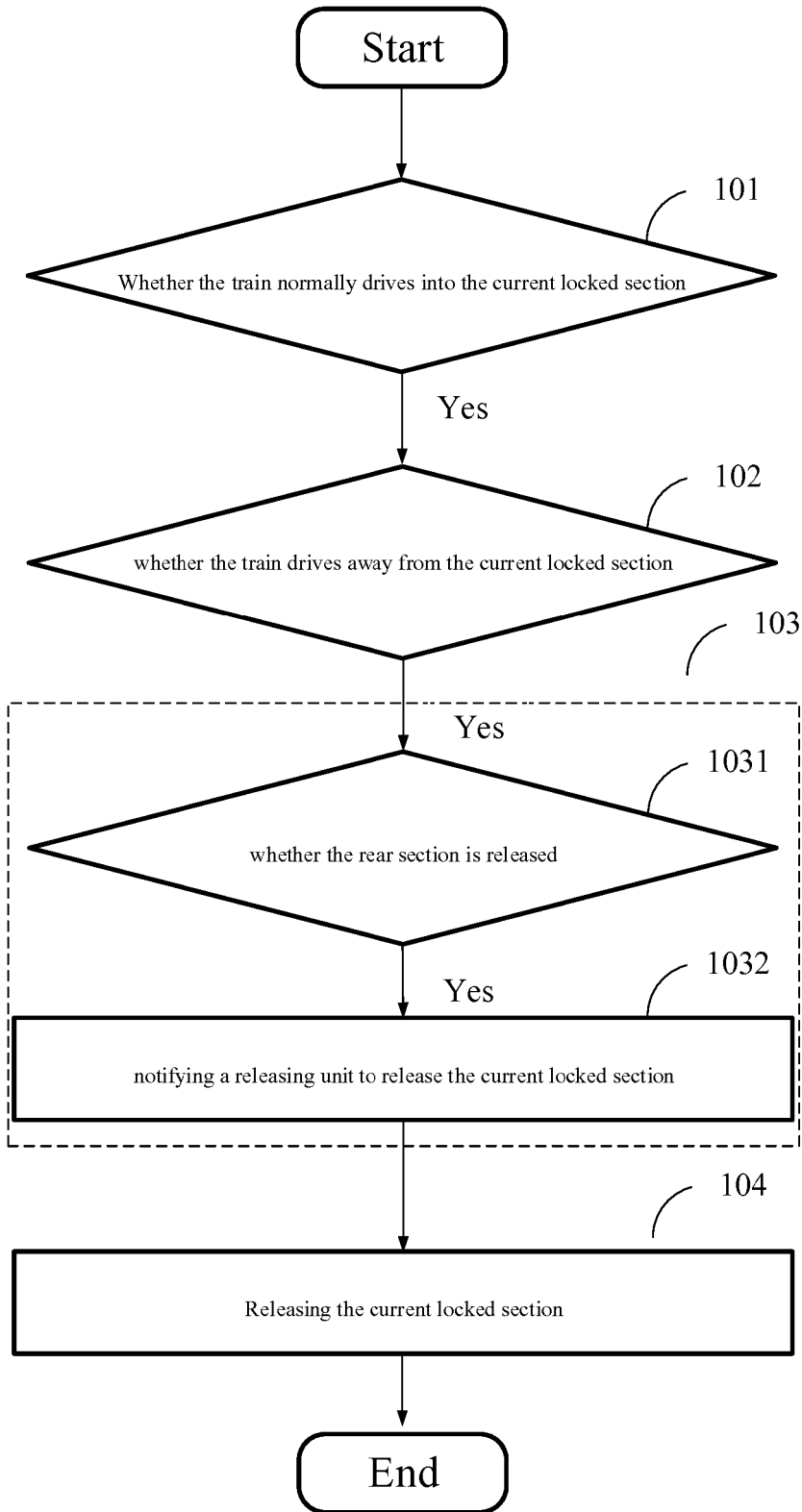


FIG. 5

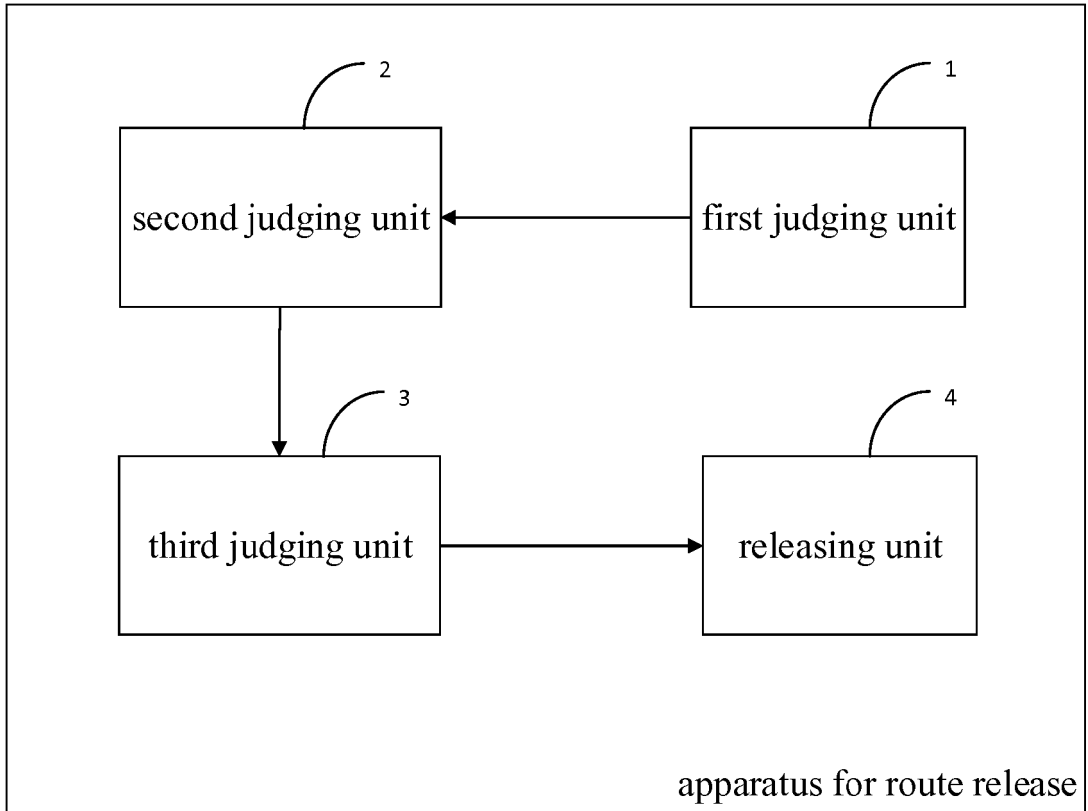


FIG. 6

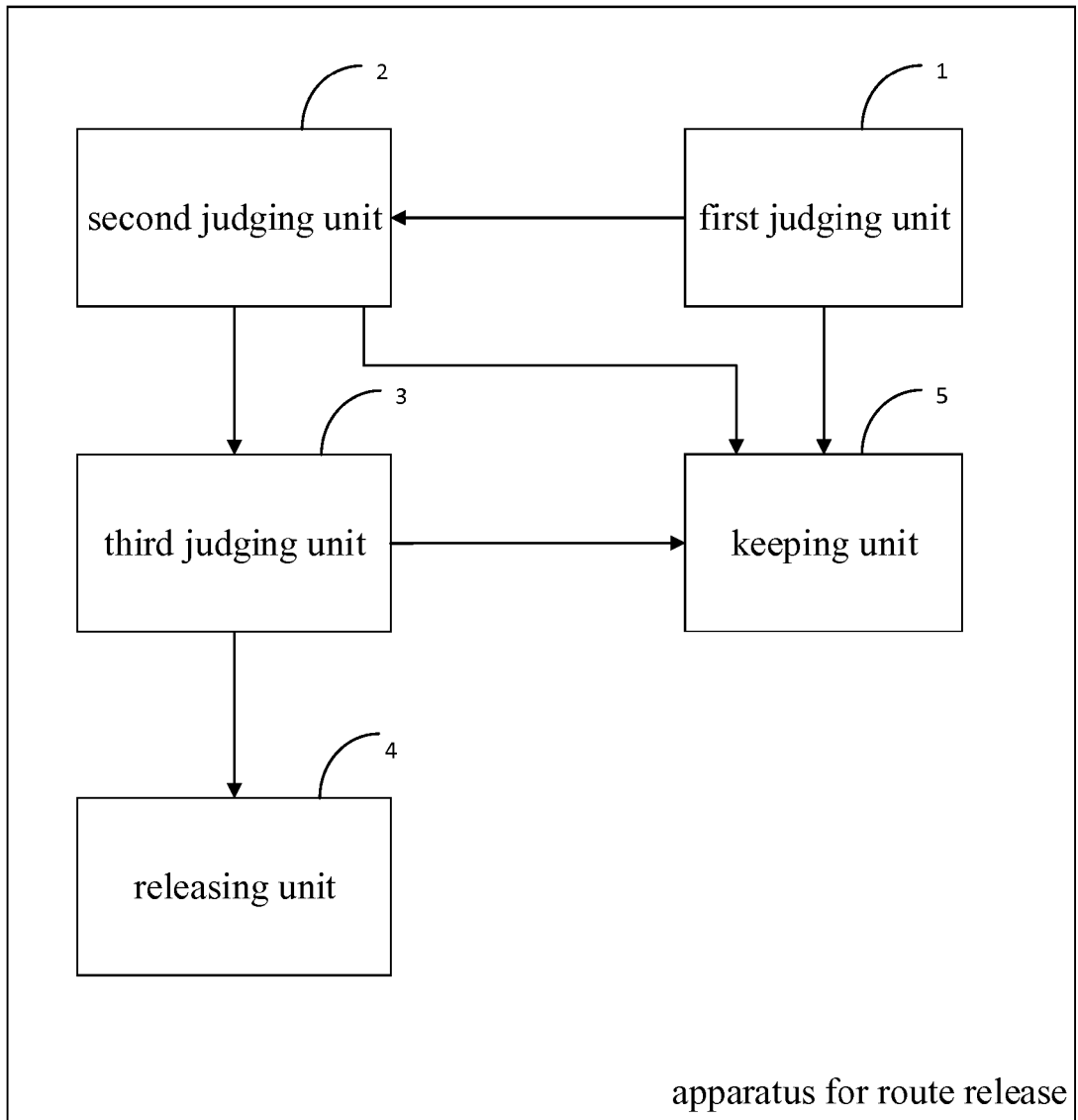


FIG. 7

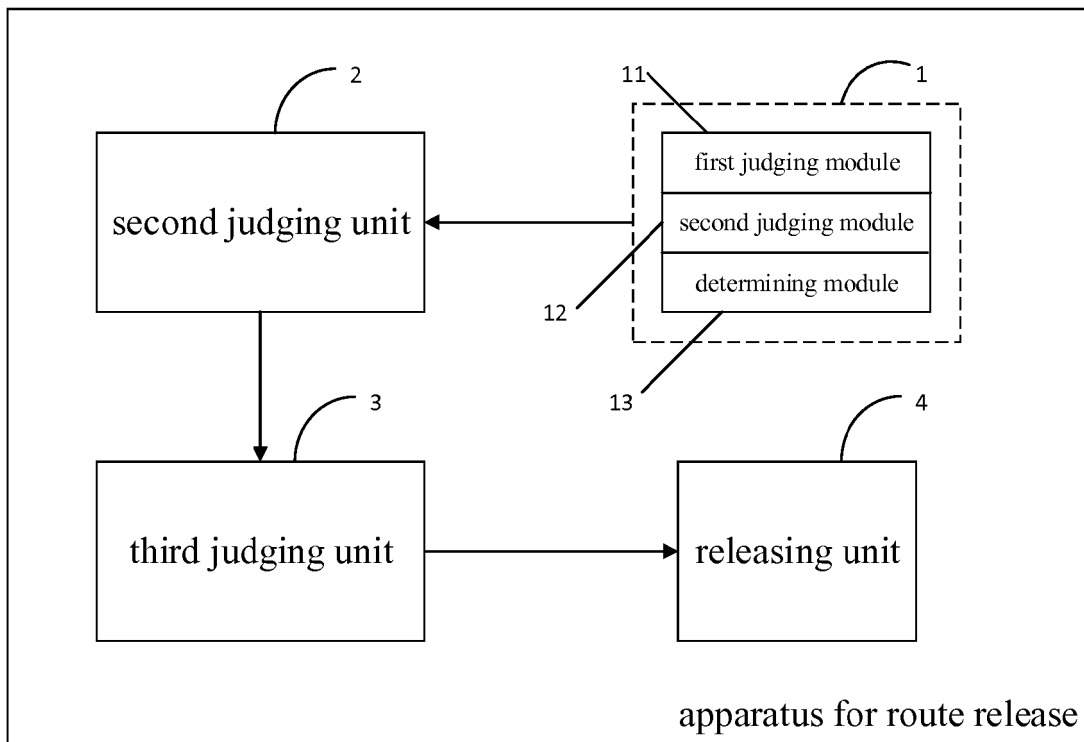


FIG. 8

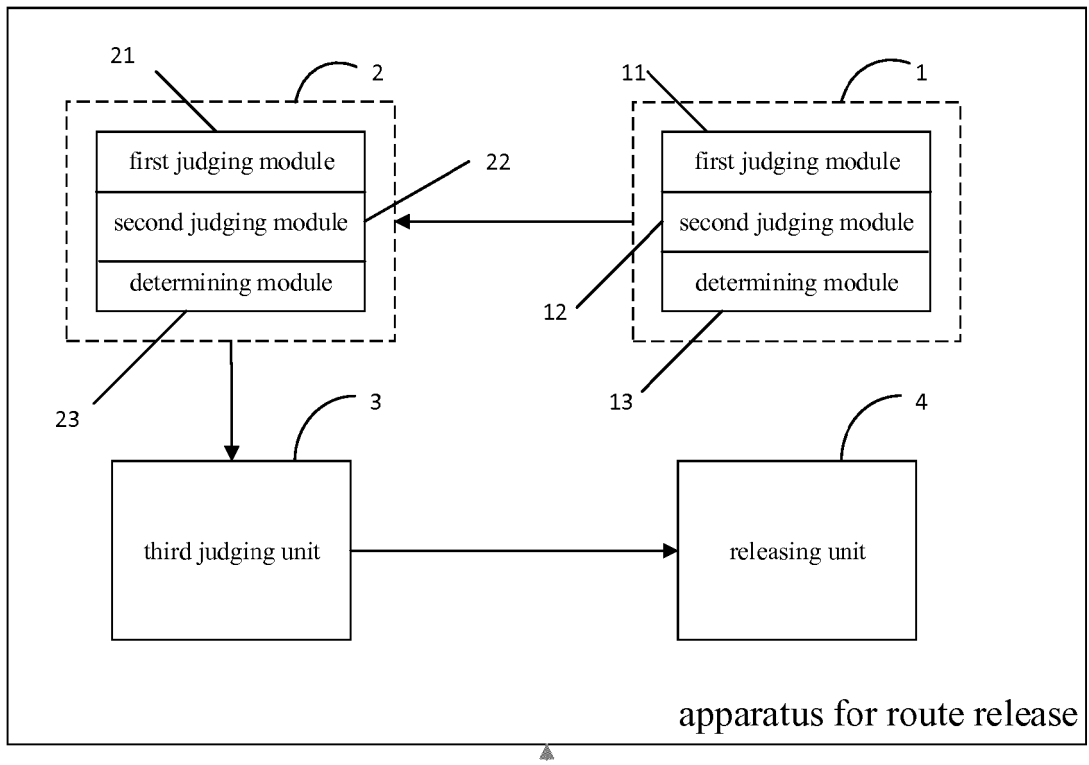


FIG. 9

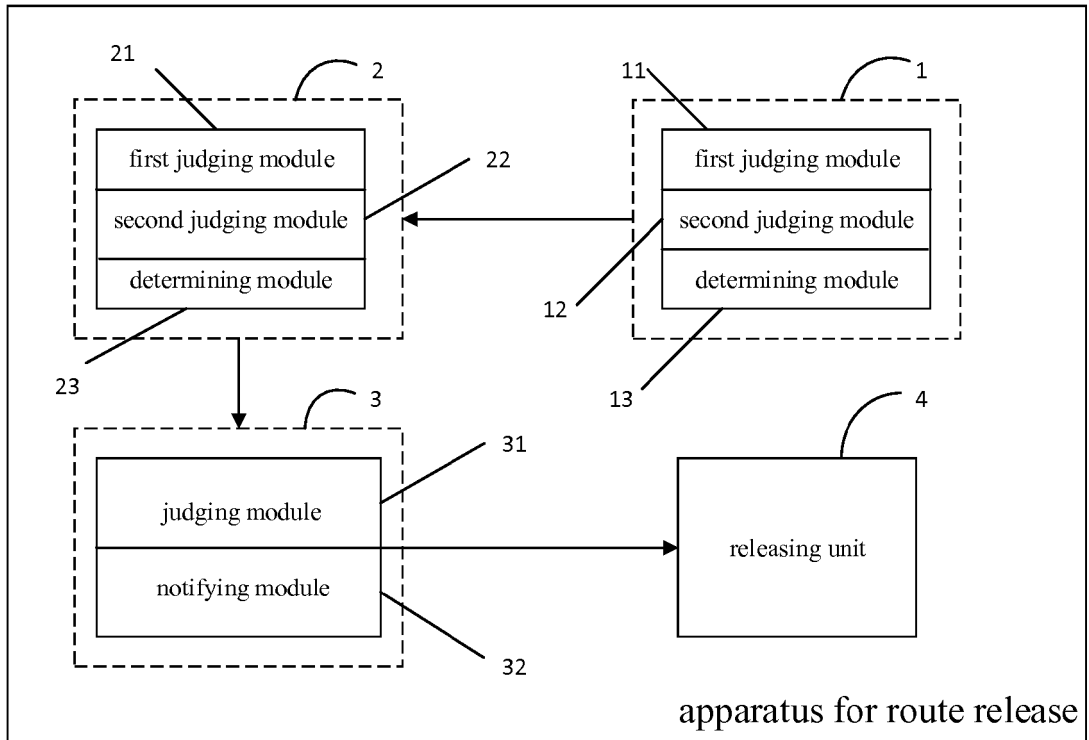


FIG. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201711113006X [0001]
- CN 106828541 A [0011]