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(54) **CTC-BASED SHUNTING PLAN MANAGEMENT AND CONTROL METHOD AND SYSTEM**

(57) The present invention discloses a centralized traffic control (CTC) shunting plan management and control method and system. The method includes: first, compiling a rolling shunting plan based on configuring a rolling area and marking rolling trip plans; then, generating a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, wherein a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and finally, triggering the rolling route, and processing the rolling route to a destination section at one time without allowing segmented processing according to short routes. The above management and control method controls the rolling route, the route equipment is not unlocked when pulling in, and the locomotive returns directly along an original rolling route when it returns, eliminating the processing step of a return route and improving the safety and efficiency of shunting operations.

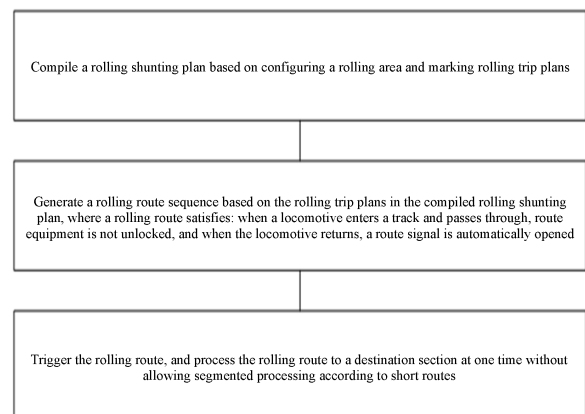


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention belongs to the technical field of rail transit, and in particular relates to a centralized traffic control (CTC) shunting plan management and control method and system.

BACKGROUND ART

[0002] In existing railway shunting operations, computer interlocking systems, CTC systems, routes, train operations, shunting operations, rolling routes, and stored rolling are involved. The computer interlocking system, referred to as interlocking for short, is responsible for controlling signal equipment in stations, including turnouts, sections, and signals, as well as restricting the safety interlocking relationships between turnouts, signals, and track circuits within a route. It accepts control instructions from operators, controls outdoor railway signal equipment such as turnouts, sections, and signals, and feeds back the status of signal equipment in real time. The jurisdiction of one set of interlocking system covers one station. CTC is widely applied in the field of railway dispatching command and signal control, and is an important equipment for railway transportation management. It realizes the informatization of dispatching command, automation of train operations, and centralization of signal equipment. CTC integrates signal systems and information systems such as interlocking systems, train control systems, and speed restriction systems, and connects stations and sections in series to form a complete line display diagram for dispatchers and station operation personnel. It serves as the eyes and hands of dispatchers, who can view the status of each signal equipment at every station, the position information and plan information of each train through the CTC system, and remotely control signal equipment as well as the operation path and speed of trains. A route refers to the path taken by trains and shunting locomotives from one location to another within a station. Route processing (or route triggering) refers to the requirement of locking the signal equipment along the route and opening the permissive signal before the locomotive enters the route. The locomotive can only enter the route after seeing the permissive signal. After the locomotive passes, the equipment returns to the cleared state (unlocked state, unoccupied state). Routes include train routes and shunting routes. Train routes are further divided into three types: receiving routes, departure routes, and through routes. A train consists of a group of vehicles (one carriage) plus a locomotive (engine) for inter-station operation. It can be roughly divided into passenger trains and freight trains. Train operations refer to operations such as receiving trains into the station, dispatching trains out of the station, trains passing through the station, as well as some inspections and passenger boarding and alighting

within the station. Signal control mainly involves the processing of receiving routes, departure routes, and through routes. Which trains are received and dispatched at each station every day is determined by the dispatcher of the corresponding line on the train diagram of the CTC system. Original route processing is completed on the interlocking system, which requires manual clicking of the start end, terminal end, and change point buttons to process the route. This method is prone to errors and lacks additional safety controls. Shunting operations refer to the movement of vehicles or locomotives within the station, including operational scenarios such as organizing a plurality of vehicles into a train, disassembling train vehicles and distributing them to various operation tracks, arranging locomotives for trains, and replacing locomotives. Each movement is referred to as a shunting trip, so the shunting plan is also called a "trip plan" or a "trip". The station dispatcher compiles the shunting operation plan based on the daily operation plan. Each shunting operation plan includes several trips, and the operators of relevant positions print out the paper shunting operation plan. Outdoor shunting locomotive drivers contact the station signalman by phone to request the processing of the shunting route for a specified trip. The signalman determines the route based on the outdoor verbal description and processes the shunting route by manually pressing the start end and terminal end signal buttons. This process is highly dependent on humans, and the accuracy and safety cannot be guaranteed. In this working mode, the shunting operation order is not associated with the route, and the route request by the outdoor operation driver is not associated with the route processing. These two disconnections are compensated for by manual work, and the manual participation increases the risk of errors. Railway shunting operations are divided into locomotive pushing mode and rolling mode according to the operation method. Rolling mode shunting operations can be further divided into humping and flat rolling. Humping is realized by the hump system, and flat rolling is controlled by the interlocking system. Stored rolling refers to compiling a plurality of rolling trip plans into a form in advance, which is sequentially executed by the interlocking system.

[0003] Furthermore, CTC provides shunting plan management and route signal control, which is currently only applied to shunting operations under the locomotive pushing mode. Shunting operations in the rolling mode realize vehicle movement by utilizing vehicle inertia, and the locomotive does not need to follow the vehicles. Rolling can be divided into humping and flat rolling. Due to the lack of interface specifications between CTC and the hump system, and since the existing interface specifications do not stipulate rolling-related control commands and protocols for storing rolling plans, the management and control of humping have not been realized. For stations with flat rolling operations, the rolling routes are controlled by the interlocking system. Moreover, since the existing CTC and interlocking inter-

face content does not include flat rolling route control, that is, all stations involving rolling currently rely on the interlocking system for control, these stations can only use the original interlocking system to control signals and cannot realize centralized CTC dispatching control. Station operation personnel are unable to use CTC functions such as incorrect route processing prevention, automatic route triggering, and operation process control, which can improve the efficiency and safety of train shunting operations.

[0004] How to control flat rolling operations through CTC has increasingly become an urgent technical problem to be solved.

SUMMARY

[0005] In response to the above problems, the present invention provides a CTC shunting plan management and control method and system, which improves the efficiency and safety of train shunting operations.

[0006] An objective of the present invention is to provide a CTC shunting plan management and control method, including:

compiling a rolling shunting plan based on configuring a rolling area and marking rolling trip plans;

generating a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, where a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and

triggering the rolling route, and processing the rolling route to a destination section at one time without allowing segmented processing according to short routes.

[0007] Further, configuring the rolling area includes:

configuring a name of a rolling point section and a name of a rolling destination track; and

determining the rolling area based on the configured name of the rolling point section and the configured name of the rolling destination track.

[0008] Further, the compiled rolling shunting plan includes the rolling trip plans and push and pull trip plans, and marking the rolling trip plans includes: adding marks for a start of rolling and an end of rolling in the rolling trip plans.

[0009] Further, each of the rolling trip plans corresponds to a unique rolling route, where both a start end and a terminal end of the rolling route are fixed.

[0010] Further, generating the rolling route sequence based on the rolling trip plans in the compiled rolling

shunting plan further includes if a previous rolling shunting plan of the rolling trip plan is the push and pull trip plan,

generating a pull-out route from an operation track to a rolling point based on the push and pull trip plan; and

generating a pull-in route from the rolling point to the operation track based on the rolling trip plan.

[0011] Further, generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further includes if a next rolling shunting plan of the rolling trip plan is the push and pull trip plan,

generating a rolling route from a rolling point to an operation track and a pull-out route from the operation track to a turn-back point based on the rolling trip plan; and

generating a pull-in route and a pull-out route in a pushing route sequence based on the push and pull trip plan.

[0012] Further, generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further includes previewing the rolling route based on a rolling signal, where all bidirectional shunting signals of the rolling route flash white, and the route is locked.

[0013] Further, triggering the rolling route further includes:

when the rolling route is processed for the first time, a start end button being a rolling starting point button; and

when a subsequent rolling route in the rolling shunting plan is processed, if the locomotive turns back midway and pulls into a next rolling trip track, calculating short routes required to be triggered at a start end of the route according to an occupied position of the locomotive, and combining the short routes into a long route to trigger the rolling route at one time.

[0014] Further, triggering the rolling route further includes when the rolling route is triggered, checking whether a rolling function at a start end of the rolling route is enabled according to a state of a rolling indicator light, and imposing control if the rolling release function is not enabled.

[0015] Another objective of the present invention is to provide a CTC shunting plan management and control system, including:

a compilation module, configured to compile a rolling shunting plan based on configuring a rolling area and marking rolling trip plans,

a generation module, configured to generate a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, where a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and

a triggering module, configured to trigger the rolling route, and process the rolling route to a destination section at one time without allowing segmented processing according to short routes.

[0016] According to the CTC shunting plan management and control method of the present invention, the rolling route is managed and controlled, the route equipment is not unlocked when pulling in, the locomotive returns directly along an original rolling route when it returns, and the rolling route is processed at one time when the route is triggered, eliminating the processing step of a return route and improving the safety and efficiency of shunting operations. Further, this management and control method enables stations with flat rolling operations to switch to the CTC control mode, allowing station operation personnel to control rolling signals and realize the stored rolling function through CTC, and relying on CTC to improve the efficiency and safety of train shunting operations.

[0017] Further, a mixed compilation method is adopted to integrate the rolling mode shunting plan with the existing pushing mode shunting plan, realizing the adaptive generation of route sequences and route triggering for both plans.

[0018] In addition, marking the rolling trip plans ensures the accuracy of input, facilitates subsequent logical calculations, and improves the safety and reliability of the shunting plan.

[0019] Other features and advantages of the present invention will be set forth in the subsequent description, and partly become apparent from the description, or be understood through the implementation of the present invention. The objectives and other advantages of the present invention can be implemented and obtained by structures pointed out in the description, claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] To illustrate the technical solutions in the embodiments of the present invention or the prior art more clearly, the accompanying drawings required for describing the embodiments or the prior art will be briefly introduced below. Apparently, the accompanying drawings in the following description are some embodiments of the present invention. For those of ordinary skill in the art, other accompanying drawings can also be obtained based on these accompanying drawings without exerting creative labor.

FIG. 1 shows a schematic flowchart of a CTC shunting plan management and control method in an embodiment of the present invention;

FIG. 2 shows a schematic flowchart of another CTC shunting plan management and control method in an embodiment of the present invention; and

FIG. 3 shows a schematic structural diagram of a CTC shunting plan management and control system in an embodiment of the present invention.

DETAILED DESCRIPTION

[0021] To make the objectives, technical solutions, and advantages of the embodiments of the present invention clearer, the technical solutions in the embodiments of the present invention will be illustrated clearly and completely below in conjunction with accompanying drawings. Apparently, the embodiments described are part rather than all embodiments of the present invention. Based on the embodiments in the present invention, all other embodiments obtained by those of ordinary skill in the art without making creative labor fall within the scope of protection of the present invention.

[0022] As shown in FIG. 1, an embodiment of the present invention introduces a CTC shunting plan management and control method. The management and control method includes: first, compiling a rolling shunting plan based on configuring a rolling area and marking rolling trip plans; then, generating a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, where a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and finally, triggering the rolling route, and processing the rolling route to a destination section at one time without allowing segmented processing according to short routes. For ordinary pushing routes, if the locomotive turns back midway and is pressed on the turnout, a complete route cannot be established at the turnout location. It is necessary to manually confirm that the turnout is in the position required by the locomotive, manually lock each turnout one by one, and at the same time, contact outdoor staff for confirmation before the locomotive can operate. This process is both cumbersome and has potential safety hazards. Thus, in the embodiment of the present invention, the rolling route is controlled through CTC, the route equipment is not unlocked when pulling in, and the locomotive returns directly along an original rolling route when it returns, eliminating the processing step of a return route and improving the safety and efficiency of shunting operations.

[0023] As shown in FIG. 2, stations with flat rolling operations are switched to the CTC control mode. First, it is necessary to integrate CTC and the interlocking

system for rolling route control. Specifically, the CTC shunting plan management and control system described below is adopted. The CTC shunting plan management and control system has the capability of uniformly managing and controlling shunting plans, that is, it can maintain the unchanged protocol format of the existing interface specifications of CTC without affecting the existing functions, and can also expand the types of commands related to rolling establishment and rolling cancellation, thus improving the reliability and safety of shunting plan management and control.

[0024] Secondly, a rolling shunting plan is compiled, which includes configuring the rolling area and marking the rolling trip plans. Unlike ordinary pushing shunting, flat rolling shunting is limited to a designated area, so it is necessary to specify the rolling point and rolling destination track. Furthermore, configuring the rolling area includes: first, configuring a name of a rolling point section and a name of a rolling destination track; and then, determining the rolling area based on the configured name of the rolling point section and the configured name of the rolling destination track. In the embodiment of the present invention, a plurality of rolling areas can be configured. When compiling rolling trip plans, the operation tracks are restricted to within the rolling areas, thereby improving the reliability of compiling rolling shunting plans.

[0025] Further, the compiled rolling shunting plan includes rolling trip plans and push and pull trip plans. Marking the rolling trip plans includes adding marks for a start of rolling and an end of rolling in the rolling trip plans. Preferably, to distinguish between the two types of trip plans, a memo column can be set in the system. The memo column provides quick formatted input options: "start rolling" and "end rolling". The trip plans between "start rolling" and "end rolling" are denoted as rolling trip plans, otherwise as push and pull trip plans. Adopting the above method to mark rolling trip plans is not only convenient for input but also ensures input accuracy. The input results are directly used as logical data, which can participate in subsequent logical calculations and improve compilation efficiency. However, the marks are not limited to "start rolling" and "end rolling"; other marking methods are also applicable to the embodiment of the present invention.

[0026] Then, a rolling route sequence is generated, where each of the rolling trip plans corresponds to a unique rolling route, where both a start end and a terminal end of the rolling route are fixed. The rolling route is the basic route from the rolling point of the throat to the operation track. It should be noted that: the basic route refers to the route processed through the start end and terminal end buttons, which is different from the alternative route. The alternative route is a detour route processed through the start end, terminal end and several alternative buttons, with a path different from that of the basic route. In addition, manual modification of the sequence is not allowed after the rolling route sequence

is generated. Further, the rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened. Preferably, for stations with flat rolling capability, priority is given to rolling routes. Rolling routes are not limited to rolling operations but can also be used in pushing operations. This allows utilization of the characteristic of rolling routes that they remain unlocked when pulled in, eliminating the need to process the pull-out route for pushing. Therefore, applying rolling routes to the pushing shunting operation mode and leveraging the characteristics of flat rolling routes, rolling trip plans do not require generating a return pull-out route sequence from the track to the rolling point, and the locomotive returns directly along an original rolling route, eliminating the processing step of a return route and improving the safety and efficiency of shunting operations.

[0027] In the embodiment of the present invention, generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further includes: if a previous shunting plan of the rolling trip plan is a push and pull trip plan, first, generating a pull-out route from an operation track to a rolling point based on the push and pull trip plan (i.e., generating a pushing route sequence); and then, generating a pull-in route from the rolling point to the operation track based on the rolling trip plan (i.e., the rolling route). By way of example, if a rolling trip plan A follows a push and pull trip plan T, the push and pull trip plan T generates a pull-out route from an operation track to a rolling point, and the rolling trip plan A generates a pull-in route from the rolling point to the operation track. Different from the prior art, to connect with the next rolling trip plan, the pull-out point of the push and pull trip plan T is by default the rolling point and cannot be selected in the manner of the original pushing route.

[0028] In the embodiment of the present invention, generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further includes: if the next shunting plan of a rolling trip plan is a push and pull trip plan, first, generating a rolling route from a rolling point to an operation track and a pull-out route from the operation track to a turn-back point based on the rolling trip plan; and then, generating a pull-in route and a pull-out route in a pushing route sequence based on the push and pull trip plan (i.e., generating a pushing route sequence). By way of example, if a rolling trip plan A precedes a push and pull trip plan T, the push and pull trip plan T generates a pull-in route and a pull-out route, while the rolling trip plan A generates two routes: one is a rolling route from a rolling point to an operation track, and the other is an ordinary pull-out route from the operation track to a turn-back point Z. Here, the turn-back point Z is the optimal turn-back point for generating sequences according to the existing pushing route for the two trip plans, i.e., the push and pull trip plan T and the rolling trip plan A. This is because when a next trip is a push and pull trip, the

rolling operation has ended at the trip A, that is, the rolling trip plan has been completed. At this point, the rolling route is not unlocked, requiring manual cancellation of the rolling route before processing an ordinary pull-out route. Since the common turn-back point of the operation track for T and the operation track for A does not necessarily include the rolling point, to flexibly select the turn-back point, when executing the next push and pull trip plan, it is necessary to generate a route sequence in the manner of the push and pull trip plan, i.e., generating the pull-out route. Preferably, if Z is the rolling point, the unlocked rolling route can still continue to be used as the pull-out route, and the pull-out route generated by the system according to the push and pull trip plan can be directly skipped.

[0029] In the embodiment of the present invention, generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further includes previewing the rolling route based on a rolling signal, where all bidirectional shunting signals of the rolling route flash white, and the route is locked. CTC generates a route sequence according to the shunting plan. Through the route sequence, operators can quickly preview the execution effect in advance before triggering the route, which reduces the workload of shunting route processing and avoids the risk of errors caused by manually clicking a plurality of buttons to process the route. The preview enables better assurance of the accuracy of the compiled rolling shunting plan.

[0030] Finally, the rolling route is triggered. Specifically, when triggering a rolling route, the rolling route is processed to a destination section at one time without allowing segmented processing according to short routes. If this condition is not met, that is, if it is impossible to process to the destination section at one time, processing the rolling route is not allowed, which effectively ensures the safety and reliability of rolling route triggering. Further, triggering the rolling route also includes: when the rolling route is processed for the first time, a start end button being a rolling starting point button; when a subsequent rolling route (a route in other rolling trip plans in the shunting plan) is processed, if the locomotive turns back midway and pulls into a next trip (rolling trip plan) track, short routes required to be triggered are calculated at a start end of the route (i.e., a start end of a next rolling trip route) according to an occupied position of the locomotive, and the short routes are combined into a long route to trigger the rolling route at one time.

[0031] In addition, triggering the rolling route further includes when the rolling route is triggered, checking whether a rolling function at a start end of the rolling route is enabled according to a state of a rolling indicator light, and imposing control if the rolling release function is not enabled to prevent processing of an ordinary pushing route, which affects efficiency. Due to the interface between the CTC system and the interlocking system, CTC realizes the control and display of signal equipment based on the interlocking system. Therefore, CTC also

inherits the safety control functions of the interlocking system, and adds many safety control and efficiency-improving functions on the basis of the interlocking system. Thus, implementing control in flat rolling operations can ensure the safety of routes and improve the reliability of shunting operations.

[0032] As shown in FIG. 3, an embodiment of the present invention further introduces a CTC shunting plan management and control system capable of executing the above method. The management and control system is disposed in the CTC system and includes a compilation module, a generation module, and a triggering module. The compilation module is configured to compile a rolling shunting plan based on configuring a rolling area and marking rolling trip plans; the generation module is configured to generate a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, where a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and the triggering module is configured to trigger the rolling route, and process the rolling route to a destination section at one time without allowing segmented processing according to short routes.

[0033] CTC controls the rolling route through the shunting plan management and control system to realize the stored rolling function, enabling stations with flat rolling operations to switch to the CTC control mode. In addition, the rolling route is controlled through the management and control system, the route equipment is not unlocked when pulling in, and the locomotive returns directly along an original rolling route when it returns, eliminating the processing step of a return route and improving the safety and efficiency of shunting operations.

[0034] While the present invention has been described in detail with reference to the foregoing embodiments, it should be understood by those of ordinary skill in the art that they may still make modifications to the technical solutions described in the foregoing embodiments or make equivalent substitutions to some of the technical features therein; and these modifications or substitutions do not make the essence of the corresponding technical solutions depart from the spirit and scope of the technical solutions in the embodiments of the present invention.

Claims

1. A centralized traffic control (CTC) shunting plan management and control method, **characterized by** comprising:

compiling a rolling shunting plan based on configuring a rolling area and marking rolling trip plans;

generating a rolling route sequence based on the rolling trip plans in the compiled rolling shunt-

- ing plan, wherein a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and triggering the rolling route, and processing the rolling route to a destination section at one time without allowing segmented processing according to short routes.
2. The CTC shunting plan management and control method according to claim 1, **characterized in that** configuring the rolling area comprises:
 - configuring a name of a rolling point section and a name of a rolling destination track; and determining the rolling area based on the configured name of the rolling point section and the configured name of the rolling destination track.
 3. The CTC shunting plan management and control method according to claim 1, **characterized in that** the compiled rolling shunting plan comprises the rolling trip plans and push and pull trip plans, and marking the rolling trip plans comprises:
 - adding marks for a start of rolling and an end of rolling in the rolling trip plans.
 4. The CTC shunting plan management and control method according to claim 3, **characterized in that** each of the rolling trip plans corresponds to a unique rolling route, wherein both a start end and a terminal end of the rolling route are fixed.
 5. The CTC shunting plan management and control method according to claim 4, **characterized in that** generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further comprises if a previous rolling shunting plan of the rolling trip plan is the push and pull trip plan,
 - generating a pull-out route from an operation track to a rolling point based on the push and pull trip plan; and
 - generating a pull-in route from the rolling point to the operation track based on the rolling trip plan.
 6. The CTC shunting plan management and control method according to claim 4, **characterized in that** generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further comprises if a next rolling shunting plan of the rolling trip plan is the push and pull trip plan,
 - generating a rolling route from a rolling point to an operation track and a pull-out route from the operation track to a turn-back point based on the rolling trip plan; and
 - generating a pull-in route and a pull-out route in a pushing route sequence based on the push and pull trip plan.
 7. The CTC shunting plan management and control method according to claim 5 or 6, **characterized in that** generating the rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan further comprises previewing the rolling route based on a rolling signal, wherein all bidirectional shunting signals of the rolling route flash white, and the route is locked.
 8. The CTC shunting plan management and control method according to claim 1, **characterized in that** triggering the rolling route further comprises:
 - when the rolling route is processed for the first time, a start end button being a rolling starting point button; and
 - when a subsequent rolling route in the rolling shunting plan is processed, if the locomotive turns back midway and pulls into a next rolling trip track, calculating short routes required to be triggered at a start end of the route according to an occupied position of the locomotive, and combining the short routes into a long route to trigger the rolling route at one time.
 9. The CTC shunting plan management and control method according to claim 1, **characterized in that** triggering the rolling route further comprises when the rolling route is triggered, checking whether a rolling function at a start end of the rolling route is enabled according to a state of a rolling indicator light, and imposing control if the rolling release function is not enabled.
 10. A centralized traffic control (CTC) shunting plan management and control system, **characterized by** comprising:
 - a compilation module, configured to compile a rolling shunting plan based on configuring a rolling area and marking rolling trip plans,
 - a generation module, configured to generate a rolling route sequence based on the rolling trip plans in the compiled rolling shunting plan, wherein a rolling route satisfies: when a locomotive enters a track and passes through, route equipment is not unlocked, and when the locomotive returns, a route signal is automatically opened; and
 - a triggering module, configured to trigger the rolling route, and process the rolling route to a destination section at one time without allowing segmented processing according to short routes.

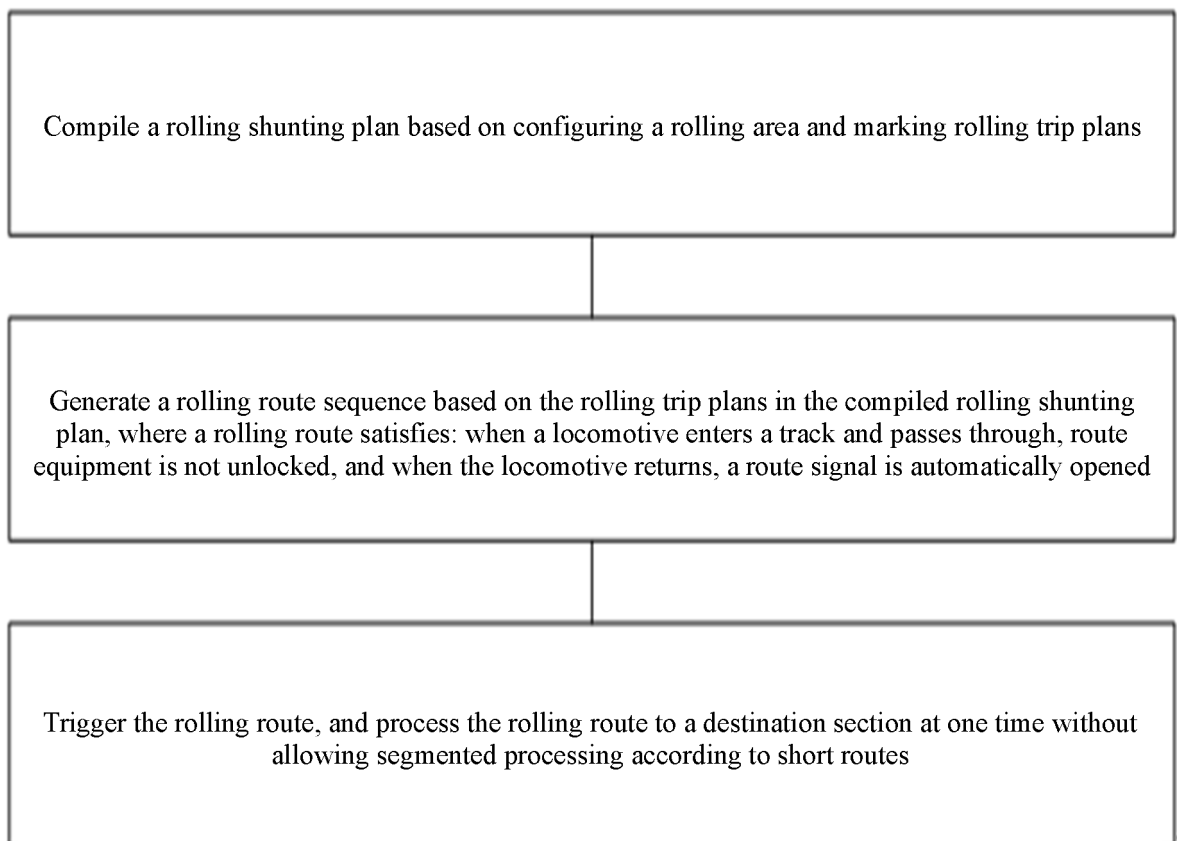


FIG. 1

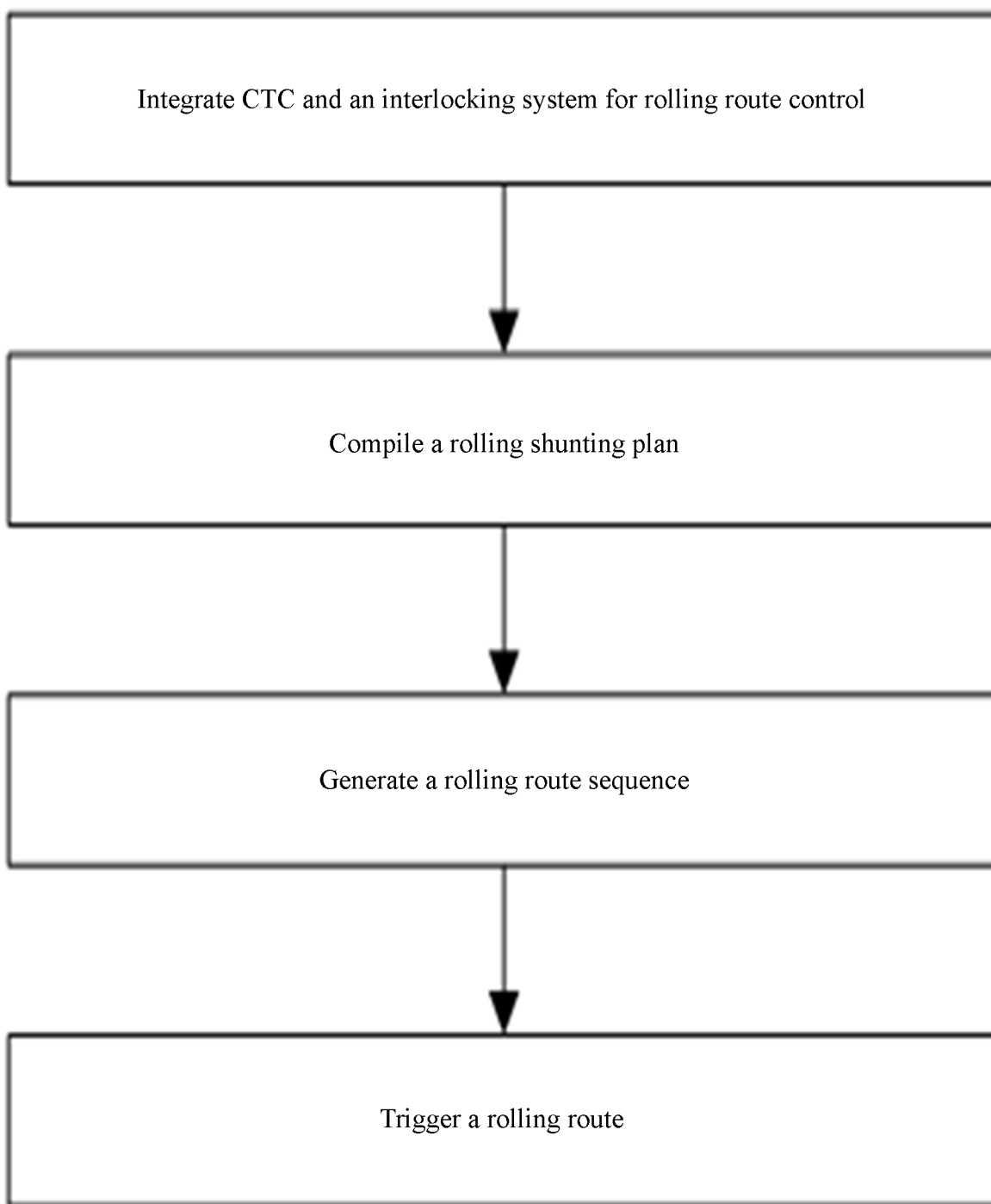


FIG. 2

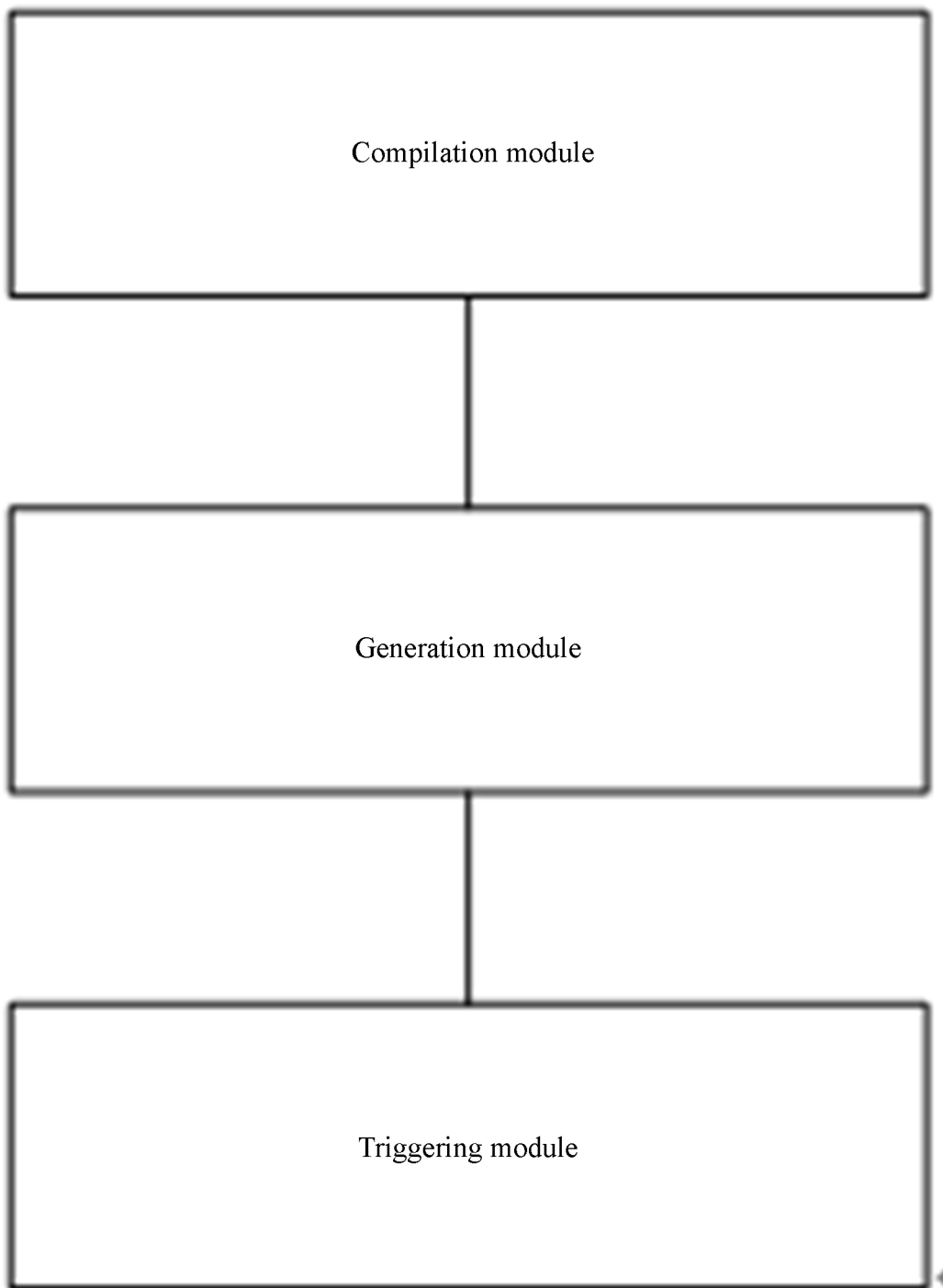


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2025/130625

A. CLASSIFICATION OF SUBJECT MATTER

B61L 27/10(2022.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B61L 27

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

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

CNTXT, ENTXTC, ENTXT, VEN, CNKI, Elsevier Science, Web of Science: 调度集中控制, 调车, 溜放, 联锁, 进路, CTC, centralized 3w control, shunt???, hump???, interlock???, route

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 113715879 A (CRSC RESEARCH & DESIGN INSTITUTE GROUP CO., LTD.) 30 November 2021 (2021-11-30) description, paragraphs [0022]-[0042], and figures 1-2	1-10
Y	兰州铁路局 编写 (compiled by Lanzhou Railway Bureau). "驼峰信号工岗位安全培训教材 (Non-official translation: Safety Training Manual for Hump Signal Workers)" 中国铁道出版社 (China Railway Publishing), First edition, November 2006, 30 November 2006 (2006-11-30), text, chapter 4, sections 1-3, and pages 114-117	1-10
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A	CN 116605266 A (CASCO SIGNAL LTD.) 18 August 2023 (2023-08-18) entire document	1-10
A	CN 119078925 A (CASCO SIGNAL LTD.) 06 December 2024 (2024-12-06) entire document	1-10

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

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Date of the actual completion of the international search

23 January 2026

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2025/130625

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005029055 A (HIGASHI NIPPON RYOKAKU TETSUDO) 03 February 2005 (2005-02-03) entire document	1-10
A	王金香 等编 (edited by WANG, Jinxiang et al.). "车站调车作业 (Non-official translation: Station Shunting Operations)" 西南交通大学出版社 (Southwest Jiaotong University Press), First edition, February 2013, 28 February 2013 (2013-02-28), pages 86-93	1-10
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TRANSLATION

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2025/130625

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CN	113715879	A	30 November 2021	None			
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CN	116605266	A	18 August 2023	None			
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