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# (54) SHUNTING OPERATION MANAGEMENT AND CONTROL METHOD AND SYSTEM

(57) A shunting operation management and control method, comprising: a station management information system acquiring a shunting operation order and sending the shunting operation order to a centralized traffic control system; the centralized traffic control system receiving the shunting operation order, determining a turnaround point according to the shunting operation order, generating a route sequence, and distributing same to each branch terminal; a wireless shunting locomotive signal and monitoring system acquiring a route shunting handling request and sending the route shunting handling request to the centralized traffic control system; the centralized traffic control system handling a route according to the route shunting handling request and the route sequence, and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation; and the centralized traffic control system sending to the station management information system a reporting point after each operation is completed, so as to implement management and control of a shunting system. Also provided is a shunting operation management and control system.

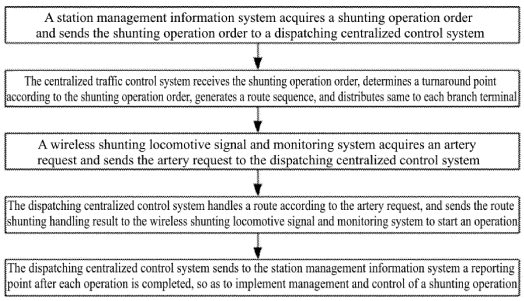


FIG. 1

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## Description

### TECHNICAL FIELD

**[0001]** The present invention pertains to the field of rail traffic control, and in particular, relates to a shunting operation management and control method and system.

### BACKGROUND

**[0002]** CTC (Centralized Traffic Control System) has been widely used in railways and has greatly promoted the modernization of railway transportation management, enabling the informationization of dispatching command, the automation of train operation and the centralization of signal equipment management. Especially after the promulgation of the CTC3.0 technical conditions of China State Railway Group Co., Ltd. in 2016, the functions of error prevention and plan management of train routes at large stations with multi-lane, multi-direction, passenger and freight mixing, and high-speed and general-speed mixing has been strengthened. However, for shunting operation, CTC has not done enough. The degree of informationization and automation is low, and the planning end and execution end are separated, which can no longer meet the transportation needs of shunting operation.

**[0003]** At present, the shunting operation process of CTC is as follows. The station dispatcher prepares the shunting operation order according to the daily operation plan, and the operators in relevant positions print out the paper shunting operation order. The outdoor dispatching driver contacts the station signalman by telephone and requests to handle the designated shunting route. The signalman determines the route according to the requirements of outdoor shunting route and handles the shunting route by manually pressing the signal button at the end. This process is highly dependent on people, and the accuracy and safety cannot be guaranteed. In this working mode, the shunting operation order is not related to the route, and the outdoor driver's route shunting request is not related to the route handling. These two disjoints are made up by manpower, and manual participation increases the risk of error.

**[0004]** Also, there are the following shortcomings in shunting operation using existing equipment at present. The outdoor dispatching driver contacts the station signalman (or attendant) by telephone to handle the shunting route (commonly known as arteries), and the station signalman handles the shunting route by manually pressing the signal button at the end, which is highly dependent on people and has potential safety hazards. The conflict between train planning and shunting operation cannot be predicted in advance. For stations with one station and multiple fields, the shunting operation coordination between stations is through manual contact, and there is no systematic process control. The shunting plan is not related to the actual operation progress, and the shunting operation progress depends on non-real-time manual records, which leads to the untimely update of the plan, low compilation accuracy and untimely update of existing vehicles. Some marshalling stations or section stations will have jurisdiction over multiple stations, so a solution to meet the control of shunting operations at one station and multiple fields is needed.

### SUMMARY

**[0005]** In view of the above problems, the present invention provides a shunting operation management and control method, the method comprises:

**[0006]** A station management information system acquiring a shunting operation order and sending the shunting operation order to a centralized traffic control system;

**[0007]** The centralized traffic control system receiving the shunting operation order, determining a turnaround point according to the shunting operation order, generating a route sequence, and distributing same to each branch terminal;

**[0008]** A wireless shunting locomotive signal and monitoring system acquiring a route shunting handling request and sending the route shunting handling request to the centralized traffic control system;

**[0009]** The centralized traffic control system handling a route according to the route shunting handling request and the route sequence and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;

**[0010]** The centralized traffic control system sending to the station management information system a reporting point after each operation is completed so as to implement management and control of a shunting operation.

**[0011]** The present invention also provides a method of managing and controlling a shunting operation according to a route shunting request, the method comprises:

**[0012]** A wireless shunting locomotive signal and monitoring system acquiring a route shunting handling request and sending the route shunting handling request to a centralized traffic control system;

**[0013]** The centralized traffic control system handling a route according to the route shunting handling request and the route sequence and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;

**[0014]** The centralized traffic control system sending to the station management information system a reporting point after each operation is completed so as to implement management and control of the shunting operation.

**[0015]** Further, the centralized traffic control system handling the route according to the route shunting handling request and the route sequence comprises automatically triggering route and manually triggering route.

**[0016]** Further, when the route is manually triggered, comprising the steps of previewing the designated hook

for the route:

wherein, previewing the designated hook for the route comprises a handled route path, and the conflict situation between the handled route path and a train plan.

**[0017]** Further, after the centralized traffic control system determining a turnaround point and generating the route sequence further comprises a step of automatically route preview, wherein, the centralized traffic control system previews that the whole route is correct and then distributes same to each branch terminal.

**[0018]** Further, the centralized traffic control system utilizes a single-track configuration to determine the turnaround point, wherein, a turnaround point priority is configured for each track according to the role of the final track.

**[0019]** Further, the manually triggering of previewing the designated hook for the route further comprises a step of route changing, and the route changing method comprises changing the turnaround point and selecting a change button.

**[0020]** The present invention also provides a system for managing and controlling a shunting operation according to a route shunting request, the system comprises:

**[0021]** The wireless shunting locomotive signal and monitoring system for acquiring a route shunting handling request and sending the route shunting handling request to a centralized traffic control system;

**[0022]** The centralized traffic control system connected with the wireless shunting locomotive signal and monitoring system and used for handling the route according to the route shunting handling request and the route sequence and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start the operation;

**[0023]** The centralized traffic control system connected with a station management information system and used for sending to the station management information system a reporting point after each operation is completed so as to implement management and control of the shunting operation.

**[0024]** The present invention further provides a shunting operation management and control system, the system comprises:

A station management information system for acquiring a shunting operation order and sending the shunting operation order to a centralized traffic control system;

The centralized traffic control system connected with the station management information system and used for receiving the shunting operation order, determining the turnaround point according to the shunting operation order, and generating a route sequence and distributing same to each branch terminal;

The wireless shunting locomotive signal and monitoring system connected with the centralized traffic control system and used for acquiring the route shunting handling request and sending the route shunting handling request to the centralized traffic control system;

The centralized traffic control system is further used for handling a route according to the route shunting handling request and the route sequence and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;

The centralized traffic control system is further used for sending to the station management information system a reporting point after each operation is completed so as to implement management and control of a shunting operation.

**[0025]** Further, the centralized traffic control system is further used for handling a route according to the route shunting handling request, comprising automatically triggering route and manually triggering route.

**[0026]** Further, the centralized traffic control system is further used for automatically previewing the route sequence generated after determining the turnaround point.

**[0027]** Further, the centralized traffic control system is further used for determining the turnaround point using a single-track configuration, wherein the turnaround point priority is configured for each track according to the role of the final track.

**[0028]** The shunting operation management and control method and system of the present invention bridges the gap between the shunting operation order of the station management information system, the route handling of the centralized traffic control system, the wireless shunting locomotive signal and the monitoring of the arteries and is a complete solution to the shunting operation flow. Full consideration to the shunting management mode of one station and multiple fields implements one point control and multiple fields linkage. The process management of shunting operation is strengthened, the efficiency of shunting operation is improved, the safety of shunting operation is enhanced, the risk of incorrectly handling the route is reduced, and the informationisation and automation level of various aspects of shunting operation is improved. Relying on the existing and mature CTC3.0 system, the present invention has the advantages of low cost, low risk and good effect.

**[0029]** Other features and advantages of the present invention will be set forth in the following specification and will become apparent in part from the specification or will be understood by practicing the present invention. The object and other advantages of the present invention can be achieved and attained by the structure pointed out in the specification the claims and the appended drawings.

## BRIEF DESCRIPTION OF DRAWINGS

**[0030]** In order to explain the embodiments of the present invention or the technical solutions of the prior art more clearly, a brief description will be given below of the drawings required for use in the description of the embodiments or the prior art. It is obvious that the drawings in the following description are some embodiments of the present invention, and other drawings may be obtained from these drawings without any creative effort by a person of ordinary skill in the art.

FIG. 1 shows a flow chart of the shunting operation management and control method in an embodiment of the present invention.

FIG. 2 shows a shunting operation role relationship connection schematic diagram in the embodiment of the present invention.

## DETAILED DESCRIPTION

**[0031]** In order to make the object, technical solution and advantages of the embodiment of the present invention clearer, the technical solution of the embodiments of the present invention will be clearly and completely described below in conjunction with the accompanying drawings in the embodiments of the present invention, and it will be apparent that the described embodiments are part of, but not all of, the 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 efforts are within the scope of protection of the present invention.

**[0032]** The present invention provides a shunting operation management and control solution based on CTC3.0 system, which is used for standardizing shunting operation flow, improving operation safety and achieving the purpose of integrating management and control.

**[0033]** According to the present invention, the telephone communication, route determination, route button selection and other processes in shunting operation are evolved into various process of the system; automatically generating route sequence according to SMIS (Station Management Information System) shunting plan (i.e. shunting operation order), and just triggering route sequence when handling route; the outdoor dispatching driver sends a route shunting handling request to CTC through STP (Shunting Train Protection) system, and CTC automatically handles the route after receiving the request; by calculating the conflict between each operation and the train plan in real time and providing the route preview function, the conflict can be predicted in advance; summarizing and managing the shunting plans and distributing same to each branch for execution, so as to implement the effect of global visibility of one shunting locomotive, one plan, and multiple operations. The present invention also feeds back the actual execution progress of the shunting operation to the SMIS planning end in real time, replacing the original manual recording mode and realizing the integration of management and control.

**[0034]** The embodiment of the present invention provides a shunting operation management and control method. FIG. 1 shows a flow chart of the shunting operation management and control method in the embodiment of the present invention. In FIG. 1, the method comprises the following steps:

The station management information system acquires the shunting operation order and sends the shunting operation order to the centralized traffic control system;

The centralized traffic control system receives the shunting operation order, and determines the turnaround point according to the shunting operation order, and generates a route sequence, and distributes same to each branch terminal;

The wireless shunting locomotive signal and monitoring system acquires a route shunting handling request and sends the route shunting handling request to the centralized traffic control system;

The centralized traffic control system handles a route according to the route shunting handling request and sends a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;

The centralized traffic control system sends to the station management information system the reporting point after each operation is completed, so as to implement management and control of a shunting operation;

The embodiment of the present invention provides a connection diagram of the personnel work with the system to perform shunting operations, and the shunting operation is controlled by the specific personnel and the system. In the process of practical application, the personnel can also be a terminal system and the like, and is not limited to special personnel, as long as the terminals and devices that can complete the management and control operation of the present invention are within the protection scope of the embodiment of the present invention.

**[0035]** As shown in FIG. 2, FIG. 2 shows a schematic connection diagram of the relationship of shunting operation roles in the embodiment of the present invention, wherein the roles include operators and system devices, and each connection line represents the routine action of the role.

**[0036]** When the personnel of the present invention cooperate with the system to carry out shunting operation control:

Step 1. The station dispatcher makes shunting operation plans according to the daily shift plan in SMIS, that is, compiles the shunting operation order;

Step 2. SMIS sends the shunting operation order to the CTC;

Step 3. The station chief attendant receives the SMIS shunting operation order in the CTC, and determines the turnaround point according to the shunting operation order, and generates the route sequence, and the CTC previews the route of the whole order is correct and distributes same to the signalman/attendant of each branch;

Step 4. The shunting driver initiates the route shunting handling request to the STP device;

Step 5. STP forwards the driver's route shunting handling request to the CTC;

Step 6. Under normal circumstances, the CTC automatically handles the route after receiving the request, and the branch attendant only needs to watch and control the shunting route correctly handled. If the route cannot be automatically triggered according to the driver's route shunting handling request in special circumstances, the branch attendant needs to intervene manually to complete the route handling;

Step 7. The CTC will feed back the handling status of the route shunting handling result to the STP, and the dispatching driver will confirm that the route signal is ready and start the operation;

Step 8. After each operation is completed, the CTC sends the time point of completion (referred to as reporting point) to SMIS, SMIS turns it into actual performance according to the shunting plan of reporting point, thus implementing the integration of management and control.

**[0037]** Specifically, when the branch attendant manually intervenes to trigger the route, he/she can preview the route, and when manually triggers the route, he/she can preview the processed route and the conflict between the route and the train plan. When there are outstanding situations, in order to enhance the flexibility and availability of the system, the system provides users with a change route set, and manually can select the change route by changing the turnaround point and selecting the change button.

**[0038]** The present invention designs a "1 + N" mode to solve the management and control problem of shunting operation in one station and multiple fields and implements the effects of global visibility of one shunting locomotive, one plan, and multiple operations. One general shunting plan management terminal is responsible for unified management of shunting plans of each shunting locomotive. The chief attendant is responsible for signing and determining the plan, including checking the plan, controlling the train sequence between fields, determining the shunting turnaround point, coordinating the shunting conflict, etc., maintaining an accurate executable plan and distributing same to N signalman terminals in the branch. The signalman terminal of each branch can check the details and implementation of all the operation orders, know the position and operation progress of the dispatching machine in time, and make preparations in advance to complete the determination and handling of the route path of the field when the dispatching machine needs to work in this field. On the premise of not changing the plan, the signalman can adjust the basic route to the changed route, and if necessary, adjust the turnaround point, and the adjusted route information will be displayed synchronously at each terminal.

**[0039]** Specifically, the N of 1+N mode can be 0, which means that there is only one attendant in the station to control the shunting route. At this time, the attendant has all the authority, that is, when there is only one attendant in the station, the attendant can preview the handled route and the conflict between the route and the train plan when manually triggering the route preview and can directly change the conflicting route to enhance the flexibility and usability of the system.

**[0040]** The CTC in the embodiment of the present invention can also carry out receiving and handling of shunting operation order, calculation of turnaround point, route search, route preview, route trigger, reporting point, shunting operation order management and the like.

**[0041]** When the CTC receives the shunting operation order in the embodiment of the present invention, the CTC and the SMIS belong to two independent systems to avoid communication obstacles due to different data definitions during signal transmission between the CTC and the SMIS. The embodiment of the present invention converts the SMIS data code into a CTC data dictionary, which mainly contains information such as station code, field number, head and tail direction, operation track, etc. This conversion is necessary for background calculation. However, the operation order information displayed to the user is consistent with the original operation order, because the naming of the SMIS is more consistent with the production habit, while the naming of the CTC continuous interlocking signal system is standardized and rigorous, but inconsistent with the customary naming, which is not conducive to communication.

**[0042]** When CTC calculates the turnaround point in the embodiment of the present invention, a shunting operation order comprises a plurality of operation plans, and CTC finds the most suitable turnaround point C according to the starting track A, the head and tail direction and the final track B of each plan. At the same time, because the turnaround point may be changed when the manual trigger of the present invention, the CTC also provides all optional turnaround point sets for manual selection. The turnaround point means that after the adjuster moves out of A, it needs to change direction at the turnaround point before reaching B. The optimal turnaround point C and other optional turnaround points need to be determined by the train attendants according to the actual operation habits on site, and then entered into the system after determination. There are so many combinations of starting track and ending track that it is necessary to find an effective and feasible method to calculate the turnaround point.

**[0043]** The present invention adopts the mode of configuring the turnaround point according to a single track, and configures the turnaround point priority for each track according to the role of the final track. From A to B, we only need to select the turnaround point from the turnaround point set of B according to the priority. If there is a connecting shunting route from A to the turnaround point, the turnaround point is the optimal turnaround point C. This method not only meets the functional requirements, but also simplifies the configuration strategy of turnaround points and simplifies the communication cost with car attendants.

**[0044]** The route search is calculated according to the turnaround point. After the turnaround point C in the embodiment of the present invention is determined, the shunting routes A to C and C to B are determined, and the CTC system generates the basic route by default. In order to enhance the flexibility and usability of the system, the system provides a change route set for users, and the change route can be selected manually by changing the turnaround point and selecting a change button.

**[0045]** Specifically, when changing routes, an operation order contains several operations. When each operation is completed, the system generates a time point to indicate that the operation is completed, and a plan generally generates one or two routes. The logic of the generation of the route is as follows:

Step a. Find the start button B 1 of the first route according to A and the head and tail direction;

Step b. Find the terminal button E2 of the second route according to B;

Step c. Check whether there is a route between the starting B 1 button and the end E2 button. If there is, the search is completed, and the route is taken as the generated route;

Step d. Find all route sets with the starting button B 1 as the starting from the route table, traversing each route R, and checking whether the end of R and the end E2 of the second route exist the route R2;

Step e. If R2 does not exist, determine whether R is a long shunting route. If R is a long shunting route, check whether the buttons and E2 on each included short shunting route section have route R3, and if so, add R and R3 to the route sequence. If R is a short shunting route, check whether the buttons and E2 on the route section have route R3, and if so, add R and R3 to the route sequence;

Step f. If R2 exists, both R and R2 are added to the route sequence, and whether the buttons on the R section and E2 have route R3 is checked, and if so, R3 is added to the route sequence.

**[0046]** The route triggering of the embodiment of the present invention comprises two modes: manual triggering and automatic triggering:

Automatic triggering: the dispatching driver sends out a shunting route request through STP terminal, and CTC automatically triggers the route after receiving the request. If the route cannot be triggered temporarily or only part of the route can be triggered temporarily, the remaining route will be triggered automatically when the triggering condition is met. Manual triggering: the trigger timing is selected manually, and the system tries to handle it once.

**[0047]** The embodiment of the present invention also describes the halfway turnaround situation in the triggering process and discloses the triggering rules of the halfway turnaround route: when handling the shunting route, the shunting operation is prevented from being affected by the short route, and the mode of moving out to the farthest end is generally adopted. In this way, it often happens that the machine turns back halfway without taking the whole path. When turning back halfway, the system recalculates the triggerable route according to the occupied position of the adjuster and completes the triggering. Trigger the complete switchboard route from the occupied position to the end to the track or the destination turnaround point one by one. If the switchboard occupies part of the route, so that the route cannot be triggered if it does not meet the interlocking conditions, and in order to make up for the signal, the system automatically locks the turnout of the route and automatically unlocks it after the switchboard operation is completed. For the sake of safety, in this case of turning back in the middle, it is necessary to ensure that the turnout position occupied by the shunting locomotive is consistent with that of the turning back route, otherwise, the route trigger and automatic single lock operation of the turnout cannot be carried out.

**[0048]** CTC can implement the preview of shunting route. CTC has automatic preview of the whole order and designated hook preview. When manually triggering the route, the handled route and the conflict between the route and the train plan may be previewed, so as to "find in advance and correct in time", which effectively reducing the possible problem caused by "executing and determining at the same time".

**[0049]** Specifically, in the embodiment of the present invention, CTC also generates and processes the reporting point, and after each operation is completed, CTC timely informs SMIS of the completion time as the reporting point for shunting identifying that the plan has been converted into actual performance. Because the situation of turning back in the middle often occurs in shunting operation, it is impossible to determine the operation completion status by unlocking the route like the train route. The CTC of the present invention takes the execution state of the following route as the basis of judgment, automatically sets the previous hook as the completion state, and sends the moment as the reporting point information to SMIS. Manual point reporting is adopted for the last hook operation, and the whole plan is completed after point reporting.

**[0050]** The embodiment of the present invention also provides a shunting operation management and control

system, the system comprises:

The station management information system is used for acquiring the shunting operation order and sending the shunting operation order to the centralized traffic control system;
The centralized traffic control system is connected with the station management information system, used for receiving the shunting operation order, determining the turnaround point according to the shunting operation order, generating a route sequence and distributing same to each branch terminal;
The wireless shunting locomotive signal and monitoring system is connected with the centralized traffic control system, and is used for acquiring the route shunting handling request and sending the route shunting handling request to the centralized traffic control system;
The centralized traffic control system is also used for handling the route according to the route shunting handling request and sending the route shunting handling result to the wireless shunting locomotive signal and monitoring system to start the operation;
The centralized traffic control system is also used for sending to the station management information system the reporting point after each operation is completed so as to implement management and control of the shunting operation.

**[0051]** Specifically, the centralized traffic control system is also used for handling a route according to the route shunting handling request, comprising automatic triggering route and manual triggering route. The centralized traffic control system is also used for automatically previewing the route sequence generated after determining the turnaround point. The centralized traffic control system is also used for determining the turnaround point by adopting a single-track configuration, wherein, the turnaround point priority is configured for each track according to the role of the final track.

**[0052]** Although 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 the technical solution described in the foregoing embodiments can still be modified or some technical features thereof can be equivalently replaced. These modifications or replacements do not depart the essence of the corresponding technical proposal from the spirit and scope of the technical proposal of the embodiments of the present invention.

## Claims

1. A method of managing and controlling a shunting operation according to a route shunting request, wherein the method comprising:

   a wireless shunting locomotive signal and monitoring system acquiring a route shunting handling request and sending the route shunting handling request to a centralized traffic control system;
   the centralized traffic control system handling a route according to the route shunting handling request and the route sequence, and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;
   the centralized traffic control system sending to the station management information system a reporting point after each operation is completed so as to implement management and control of the shunting operation.

2. A shunting operation management and control method, wherein the method comprising:

   a station management information system acquiring a shunting operation order and sending the shunting operation order to a centralized traffic control system;
   the centralized traffic control system receiving the shunting operation order, determining a turnaround point according to the shunting operation order, generating a route sequence, and distributing same to each branch terminal;
   a wireless shunting locomotive signal and monitoring system acquiring a route shunting handling request and sending the route shunting handling request to the centralized traffic control system;
   the centralized traffic control system handling a route according to the route shunting handling request and the route sequence, and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;
   the centralized traffic control system sending to the station management information system a reporting point after each operation is completed so as to implement management and control of a shunting operation.

3. The shunting operation management and control method of claim 2, wherein the centralized traffic control system handling the route according to the route shunting handling request and the route sequence comprises automatically triggering route and manually triggering route.

4. The shunting operation management and control method of claim 3, wherein the manually triggering route comprises a step of route designated hook preview:
   wherein, the designated hook preview comprises a

handled route path, and the conflict situation between the handled route path and a train plan.

**5.** The shunting operation management and control method of claim 3 or 4, wherein, after the centralized traffic control system determining a turnaround point and generating the route sequence further comprises a step of automatically route preview,
wherein, the centralized traffic control system previews that the whole route is correct and then distributes same to each branch terminal.

**6.** The shunting operation management and control method of claim 2 or 4, wherein the centralized traffic control system utilizes a single station track configuration to determine the turnaround point, wherein, a turnaround point priority is configured for each track according to the role of the final track.

**7.** The shunting operation management and control method of claim 4, wherein the manually triggering of previewing the designated hook for the route further comprises a step of route changing, and the route changing method comprises: changing the turnaround point and selecting a change button.

**8.** A system for managing and controlling a shunting operation according to a route shunting request, the system comprising:

a wireless shunting locomotive signal and monitoring system for acquiring a route shunting handling request and sending the route shunting handling request to a centralized traffic control system;
the centralized traffic control system connected with the wireless shunting locomotive signal and monitoring system, and used for handling a route according to the route shunting handling request and the route sequence, and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;
the centralized traffic control system connected with a station management information system and used for sending to the station management information system a reporting point after each operation is completed so as to implement management and control of the shunting operation.

**9.** A shunting operation management and control system, wherein, the system comprising:

a station management information system for acquiring a shunting operation order and sending the shunting operation order to a centralized traffic control system;
the centralized traffic control system connected with the station management information system and used for receiving the shunting operation order, determining the turnaround point according to the shunting operation order, and generating a route sequence and distributing same to each branch terminal;
the wireless shunting locomotive signal and monitoring system connected with the centralized traffic control system and used for acquiring the route shunting handling request and sending the route shunting handling request to the centralized traffic control system;
the centralized traffic control system is further used for handling a route according to the route shunting handling request and the route sequence, and sending a route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation;
the centralized traffic control system is further used for sending to the station management information system a reporting point after each operation is completed so as to implement management and control of a shunting operation.

**10.** The shunting operation management and control system of claim 9, wherein the centralized traffic control system is further used for handling a route according to the route shunting handling request, comprising automatically triggering route and manually triggering route.

**11.** The shunting operation management and control system of claim 10, wherein the centralized traffic control system is also used for automatically previewing the route sequence generated after determining the turnaround point.

**12.** The shunting operation management and control system of claim 9 or 10, wherein the centralized traffic control system is further used for determining the turnaround point using a single-track configuration, wherein the turnaround point priority is configured for each track according to the role of the final track.

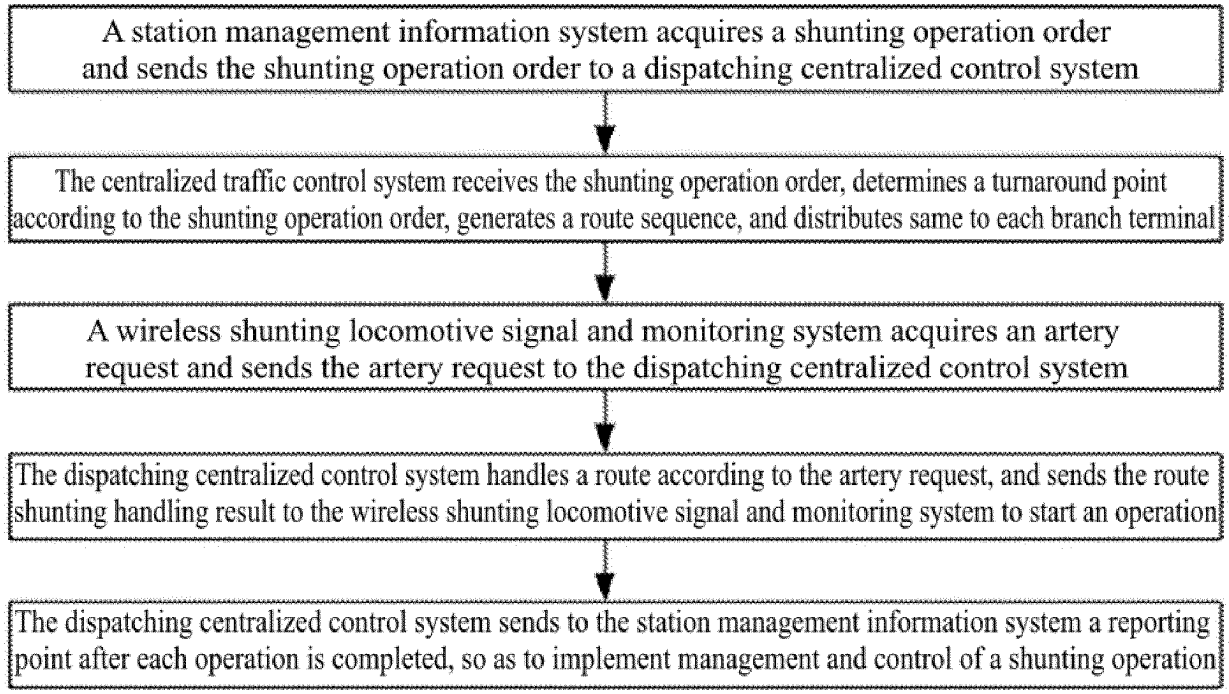
A station management information system acquires a shunting operation order and sends the shunting operation order to a dispatching centralized control system
The centralized traffic control system receives the shunting operation order, determines a turnaround point according to the shunting operation order, generates a route sequence, and distributes same to each branch terminal
A wireless shunting locomotive signal and monitoring system acquires an artery request and sends the artery request to the dispatching centralized control system
The dispatching centralized control system handles a route according to the artery request, and sends the route shunting handling result to the wireless shunting locomotive signal and monitoring system to start an operation
The dispatching centralized control system sends to the station management information system a reporting point after each operation is completed, so as to implement management and control of a shunting operation

FIG. 1

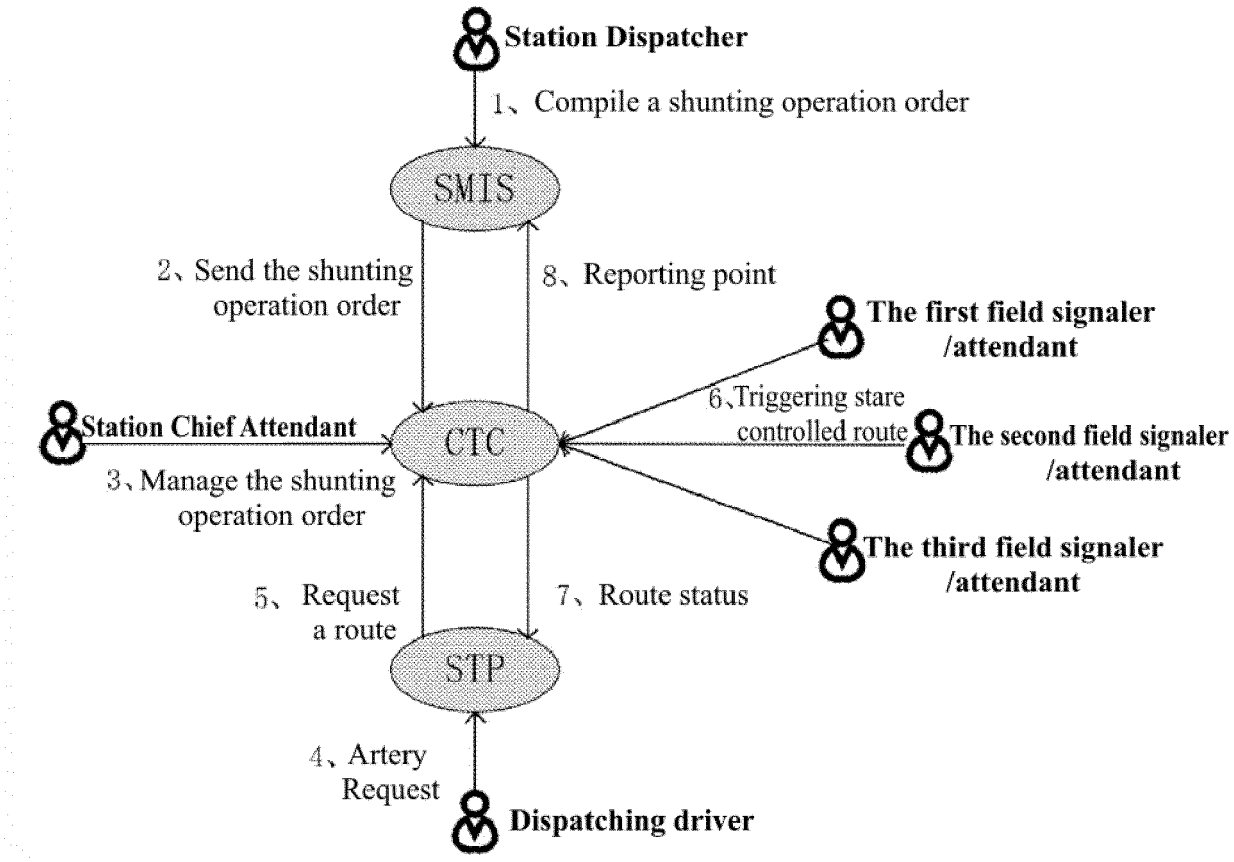
Station Dispatcher
1、Compile a shunting operation order
SMIS
2、Send the shunting operation order
8、Reporting point
The first field signaler /attendant
6、Triggering stare controlled route
Station Chief Attendant
CTC
The second field signaler /attendant
3、Manage the shunting operation order
The third field signaler /attendant
5、Request a route
7、Route status
STP
4、Artery Request
Dispatching driver

FIG. 2

## INTERNATIONAL SEARCH REPORT

International application No.
**PCT/CN2022/110618**

**A. CLASSIFICATION OF SUBJECT MATTER**

B61L 27/04(2006.01)i; B61L 27/00(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)

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: 调车, 进路, 作业单, 钩计划, 钩 3d 作业, 无线调车, 调度集中, 车站管理信息, shunt???, dispatch???, plan?, schedule?, route?, station management, central+ traffic, STP, CTC, SMIS

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | CN 106553664 A (CASCO SIGNAL LTD.) 05 April 2017 (2017-04-05)<br>description, paragraphs [0015] and [0070]-[0091], and figure 1 | 1-12 |
| PX | CN 113715879 A (BEIJING NATIONAL RAILWAY RESEARCH & DESIGN INSTITUTE OF SIGNAL & COMMUNICATION LTD.) 30 November 2021 (2021-11-30)<br>claims 1-12 | 1-12 |
| A | CN 108032876 A (BEIJING NATIONAL RAILWAY RESEARCH & DESIGN INSTITUTE OF SIGNAL & COMMUNICATION LTD.) 15 May 2018 (2018-05-15)<br>entire document | 1-12 |
| A | CN 104773191 A (SHANGHAI HENGJUN SCIENCE & TECHNOLOGY CO., LTD.) 15 July 2015 (2015-07-15)<br>entire document | 1-12 |
| A | CN 112550384 A (CASCO SIGNAL LTD.) 26 March 2021 (2021-03-26)<br>entire document | 1-12 |
| A | JP 2002002486 A (MITSUBISHI ELECTRIC CORP.) 09 January 2002 (2002-01-09)<br>entire document | 1-12 |
| A | JP 2001341645 A (NIPPON SIGNAL CO., LTD.) 11 December 2001 (2001-12-11)<br>entire document | 1-12 |

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

* Special categories of cited documents:
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| **20 September 2022** | **27 September 2022** |

| Name and mailing address of the ISA/CN | Authorized officer |
|---|---|
| **China National Intellectual Property Administration (ISA/CN)**<br>**No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** | |
| Facsimile No. **(86-10)62019451** | Telephone No. |

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/110618

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| Y | 邓庚发 等 (DENG, Gengfa et al.). "CTC3.0系统调车计划管理功能研究 (Research on Shunting Plan Management Function of CTC3.0 System)"<br>*铁路通信信号工程技术 (Railway Signalling & Communication Engineering),*<br>Vol. 15, No. 03, 25 March 2018 (2018-03-25),<br>ISSN: ,<br>sections 2-3, and figure 1 | 1-12 |
| A | 张多龙 (ZHANG, Duolong). "CTC与STP结合的调车作业控制方案 (Shunting Operation Control Scheme With Combination of CTC and STP System)"<br>*铁路通信信号 (Railway Signalling & Communication),*<br>Vol. 54, No. 09, 30 September 2018 (2018-09-30),<br>ISSN: ,<br>pages 18-21 | 1-12 |

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**INTERNATIONAL SEARCH REPORT**
**Information on patent family members**

International application No.
**PCT/CN2022/110618**

| Patent document cited in search report | Publication date (day/month/year) | Patent family member(s) | Publication date (day/month/year) |
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| | | EP 3608200 A1 | 12 February 2020 |
| | | HR P20211865 T1 | 04 March 2022 |
| | | WO 2019091063 A1 | 16 May 2019 |
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