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(54) **TOOLS FOR RAILWAY TRAFFIC CONTROL**

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Related U.S. Patent Documents

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(63) Continuation of application No. 15/928,955, filed on Mar. 22, 2018, now Pat. No. Re. 47,835, which is an application for the reissue of Pat. No. 9,403,545.
(Continued)

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B61L 23/06 (2006.01)
B61L 25/06 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B61L 27/20*** (2022.01); ***B61L 23/06*** (2013.01); ***B61L 25/06*** (2013.01); ***B61L 27/00*** (2013.01); *B61L 25/08* (2013.01)

(58) **Field of Classification Search**
CPC .. B61L 27/0038; B61L 27/0005; B61L 27/02; B61L 27/00; B61L 23/00;
(Continued)

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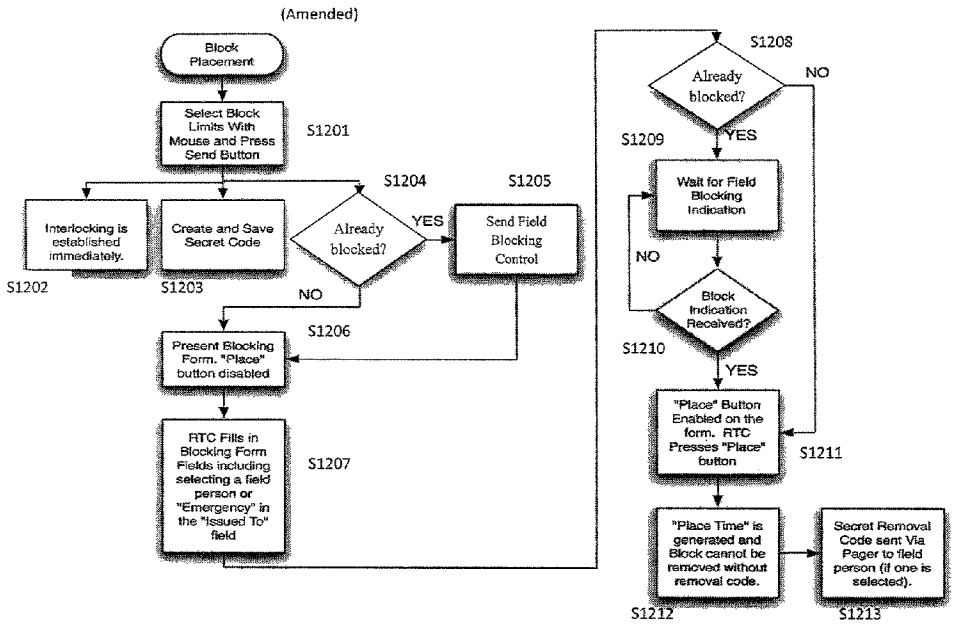
Primary Examiner — Peter C English

(57) **ABSTRACT**

Tools [(such as system, apparatus, methodology, etc.)] may be provided to control traffic over a railway track section, *and more particularly,* when a railway worker is working on or near the track section*, a block is placed to prevent trains from traversing the track section*. [Move particularly, when traffic over the track section is to be blocked] *Further*, a release code is generated and sent to [an electronic contact address of the railway worker. Traffic through the track section is blocked until the release code is entered in the system] *a user terminal. The block is removed from the track section when the release code is received by the system.*

17 Claims, 11 Drawing Sheets



Amtrak Exhibit 1001

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(51) **Int. Cl.**
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B61L 27/20 (2022.01)
B61L 25/08 (2006.01)

(58) **Field of Classification Search**
CPC B61L 23/06; B61L 23/10; B61L 19/06; B61L 2019/065; B61L 25/06; B61L 25/08; B61L 27/20
See application file for complete search history.

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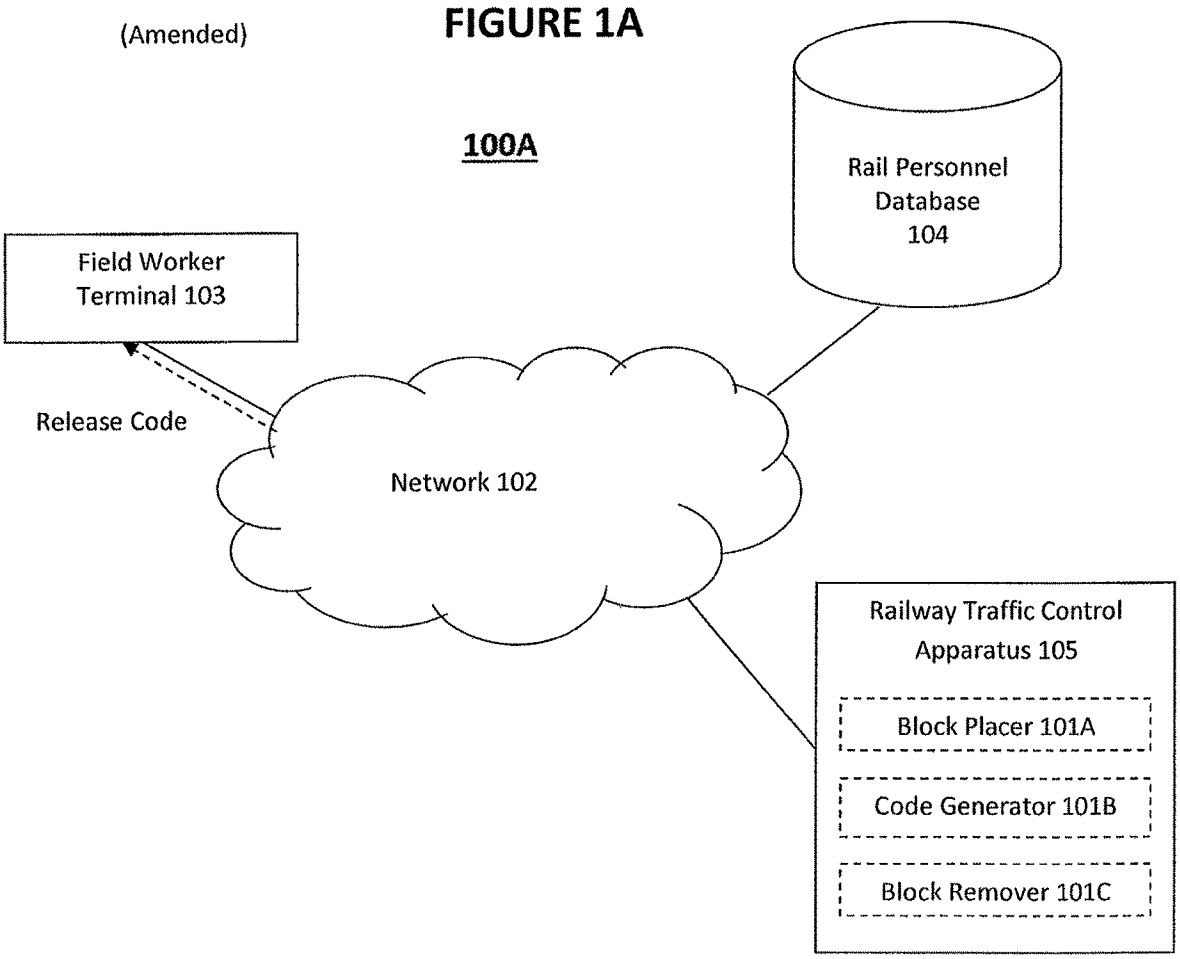
(Amended)

FIGURE 1A



(Amended)

FIGURE 1B

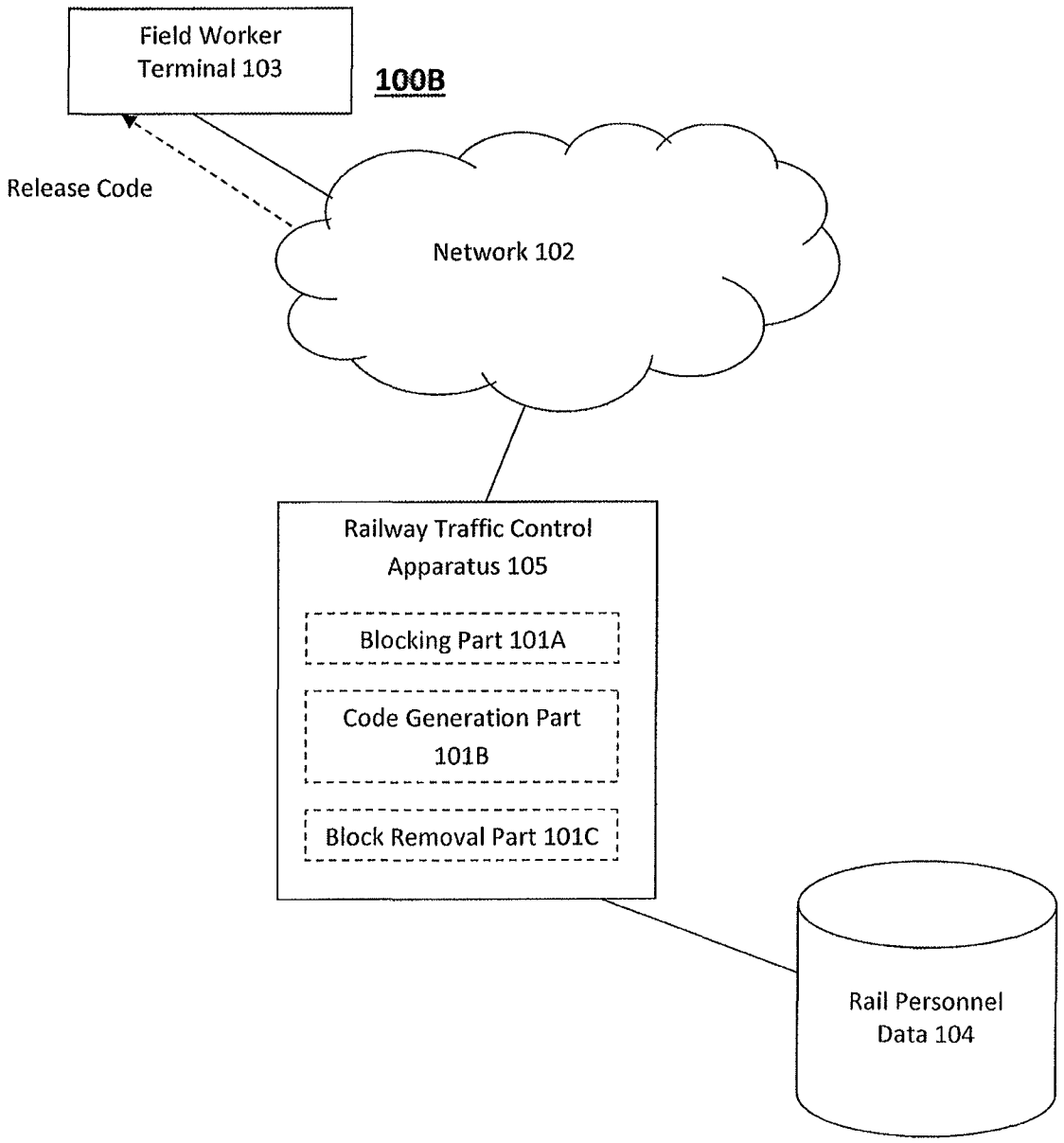


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FIGURE 2

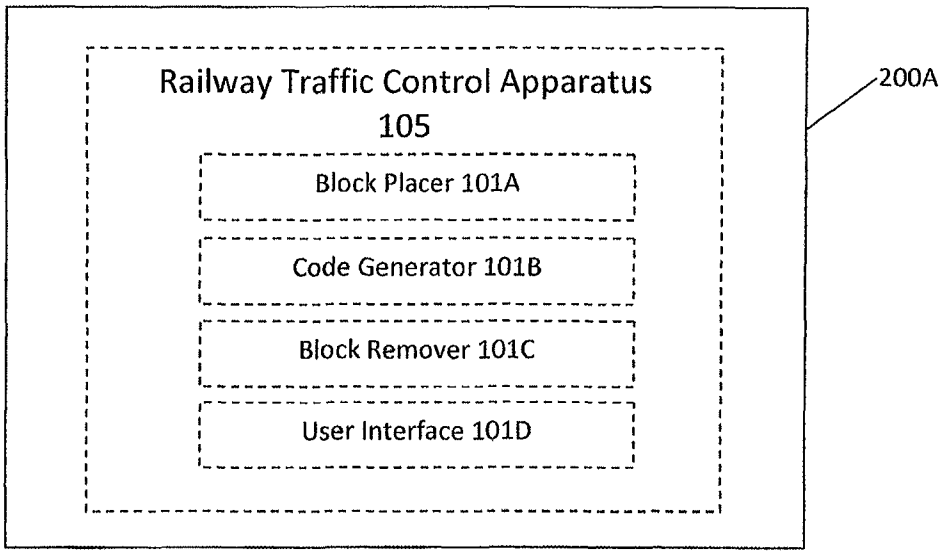
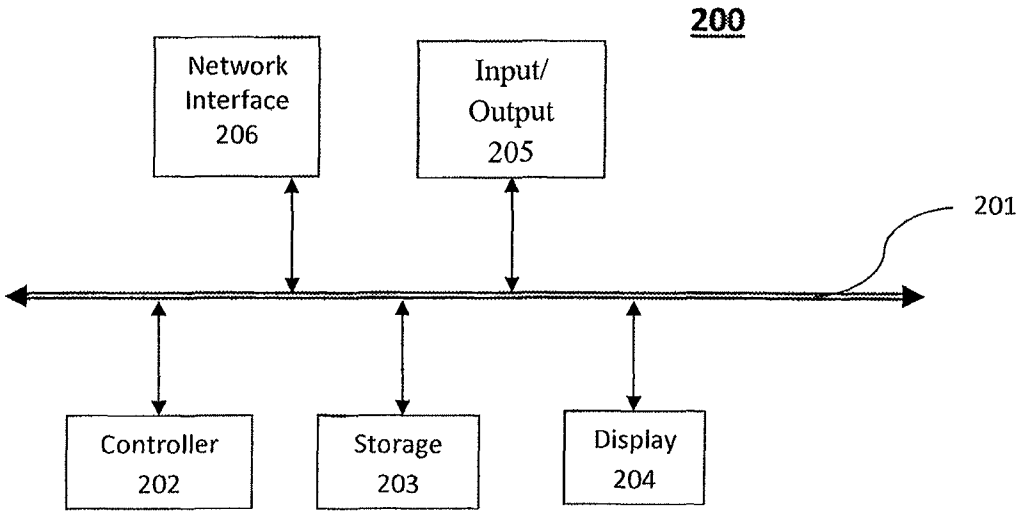


FIGURE 3A



(Amended) FIGURE 3B

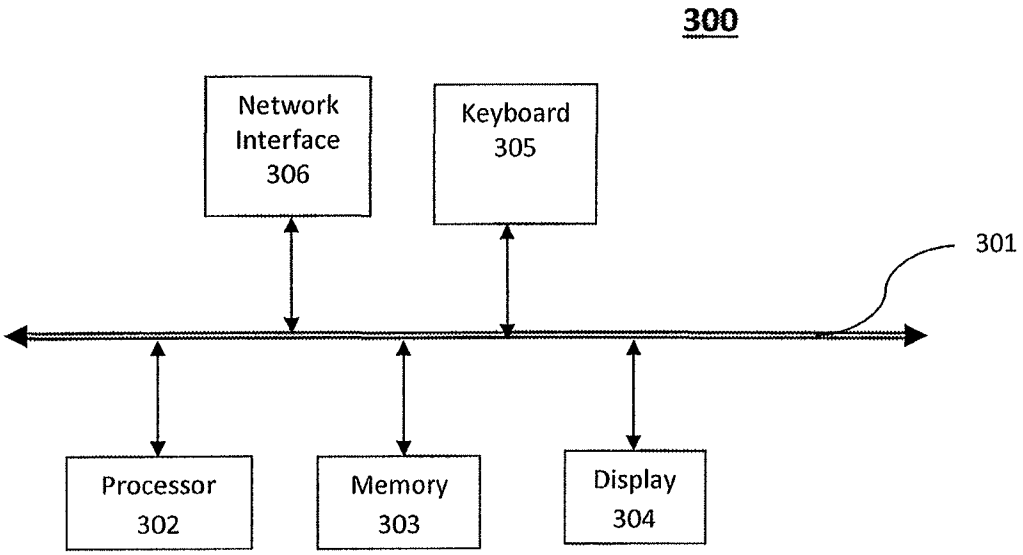
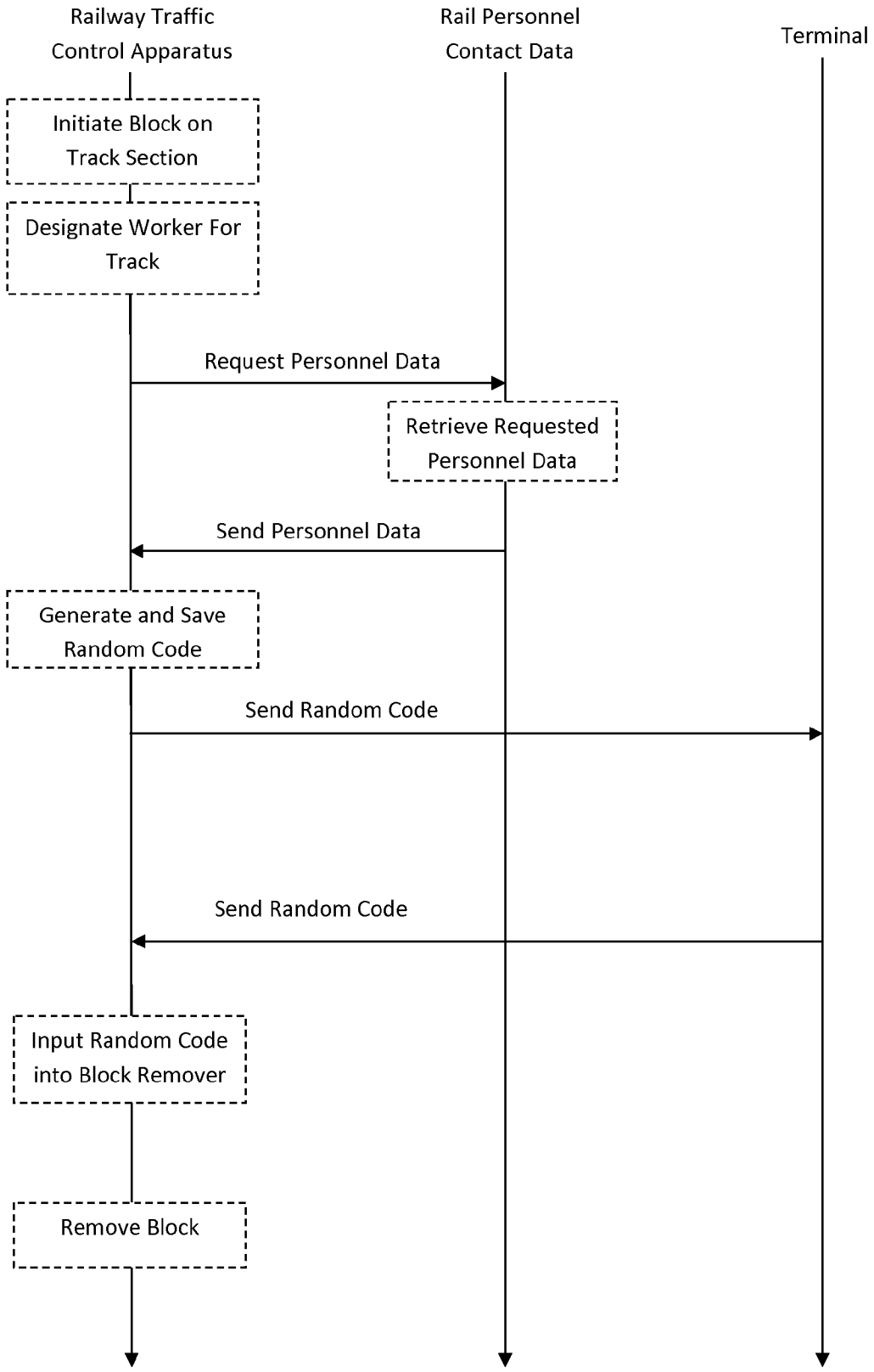


FIGURE 4


Railway Traffic Control Apparatus
Rail Personnel Contact Data
Terminal
Initiate Block on Track Section
Designate Worker For Track
Request Personnel Data
Retrieve Requested Personnel Data
Send Personnel Data
Generate and Save Random Code
Send Random Code
Send Random Code
Input Random Code into Block Remover
Remove Block

(Amended) **FIGURE 5**

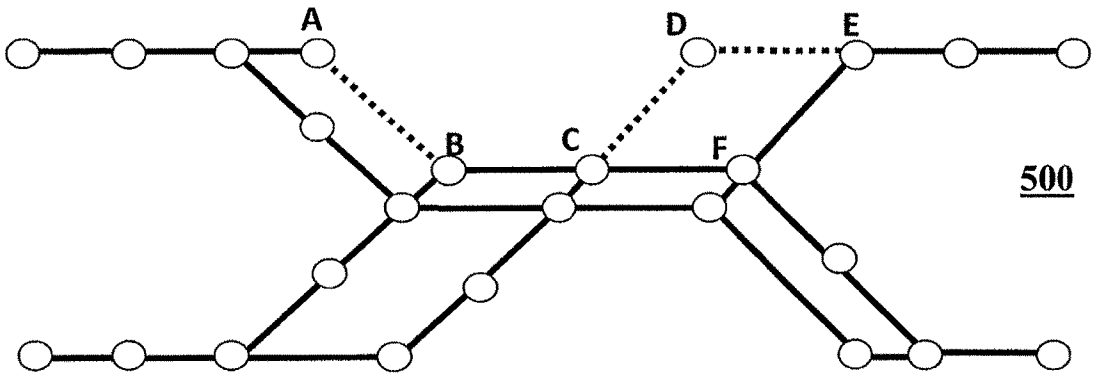
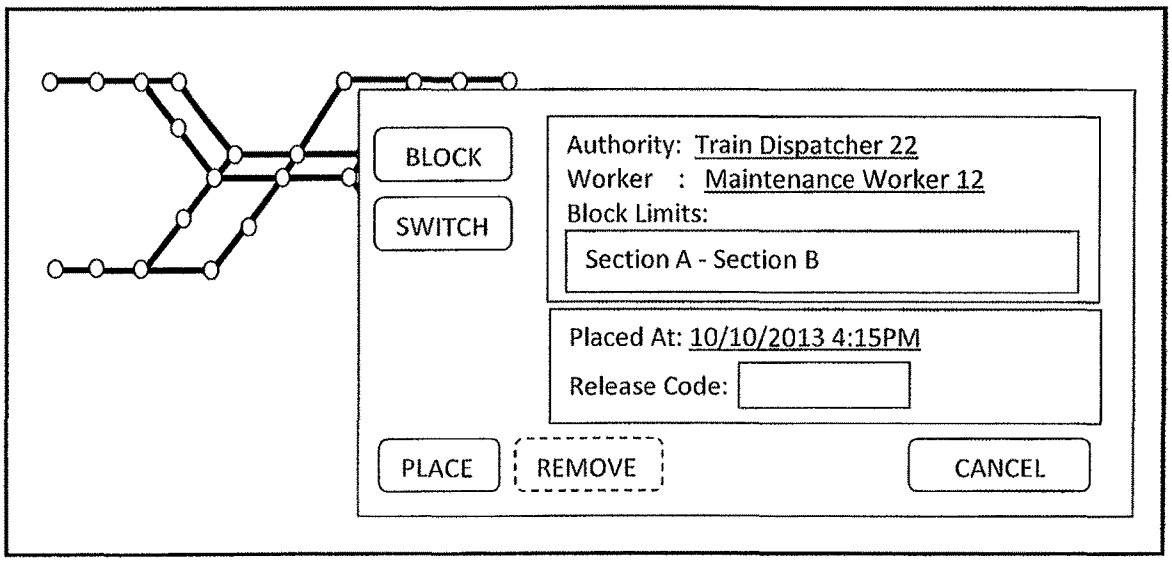
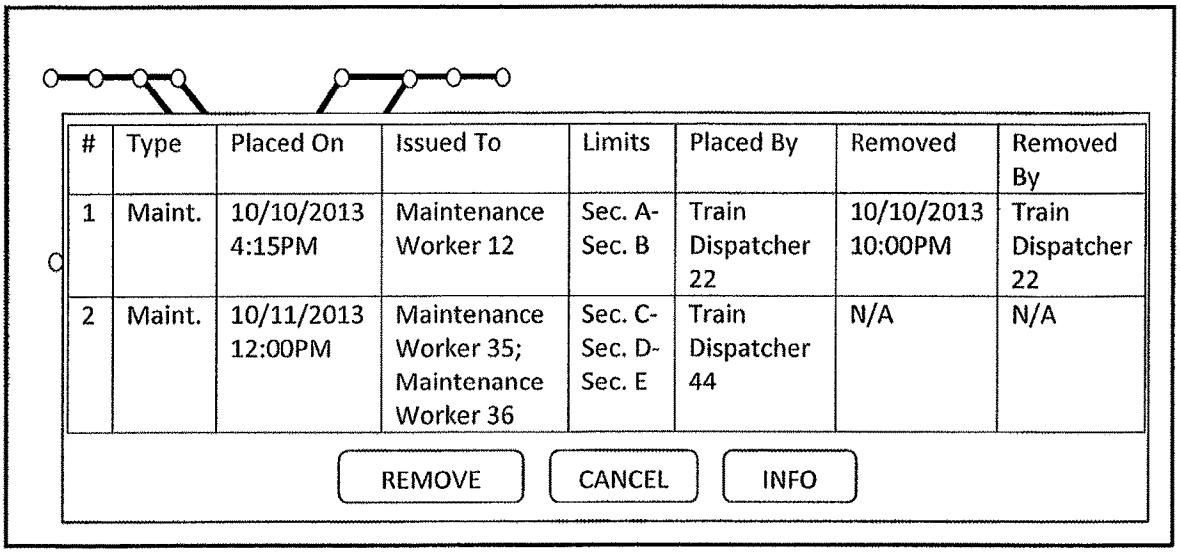


FIGURE 6



(Amended)

FIGURE 7



#	Type	Placed On	Issued To	Limits	Placed By	Removed	Removed By
1	Maint.	10/10/2013 4:15PM	Maintenance Worker 12	Sec. A-Sec. B	Train Dispatcher 22	10/10/2013 10:00PM	Train Dispatcher 22
2	Maint.	10/11/2013 12:00PM	Maintenance Worker 35; Maintenance Worker 36	Sec. C-Sec. D-Sec. E	Train Dispatcher 44	N/A	N/A

FIGURE 8

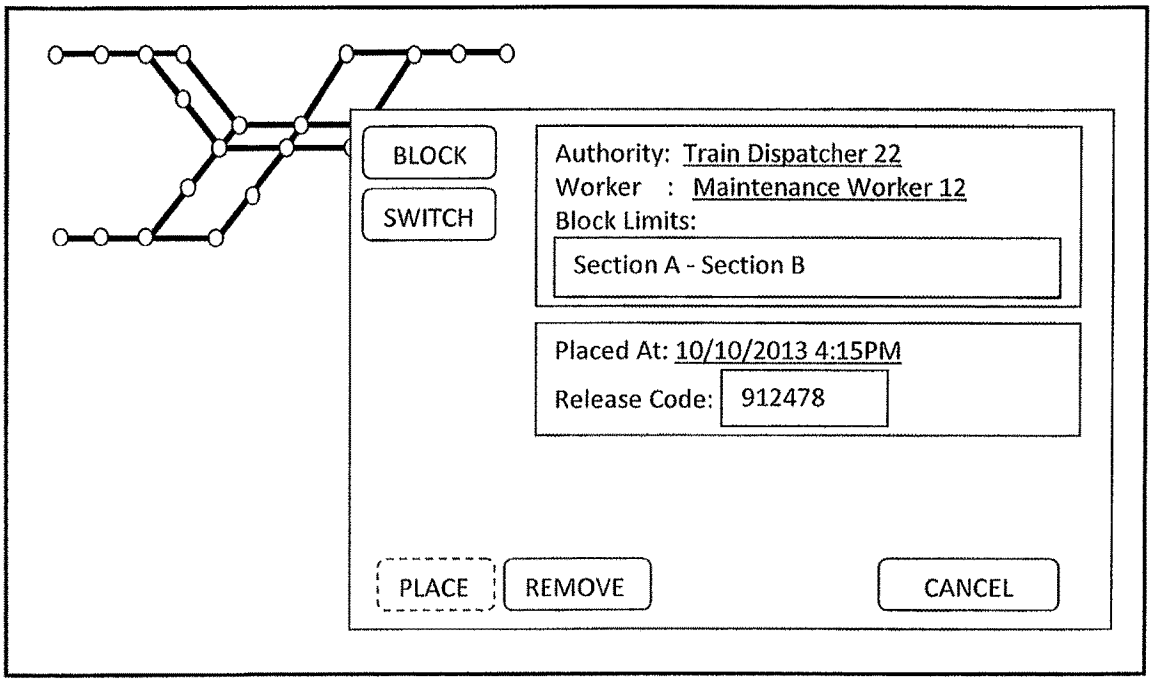


FIGURE 9

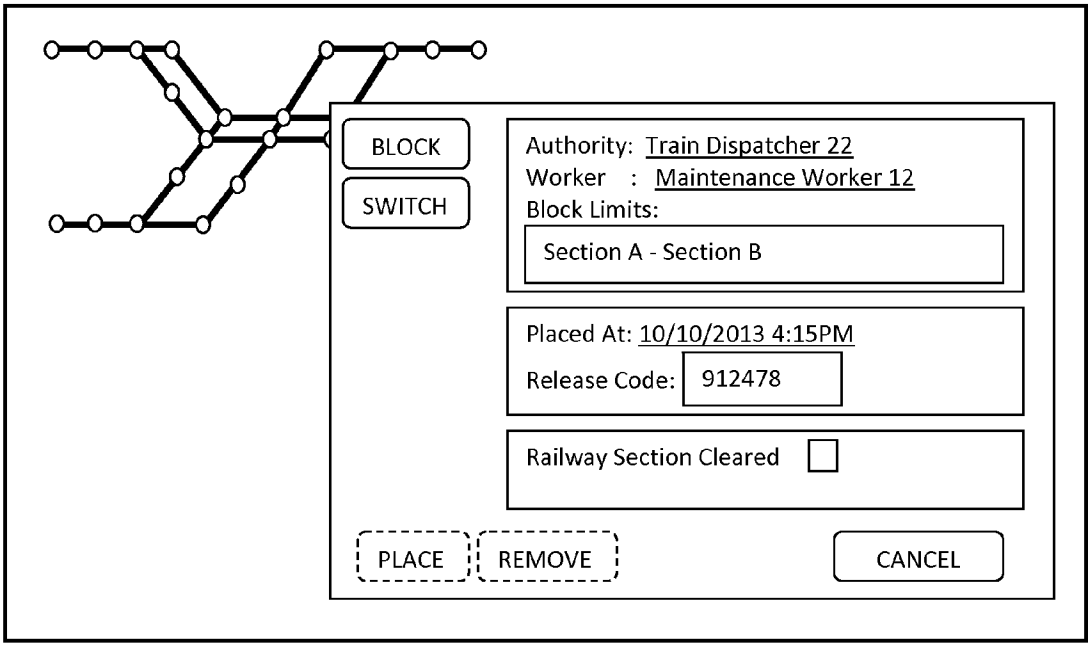


FIGURE 10

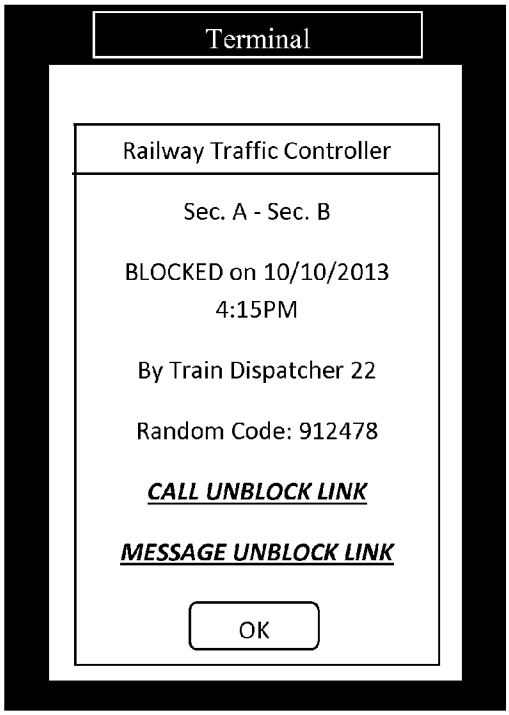
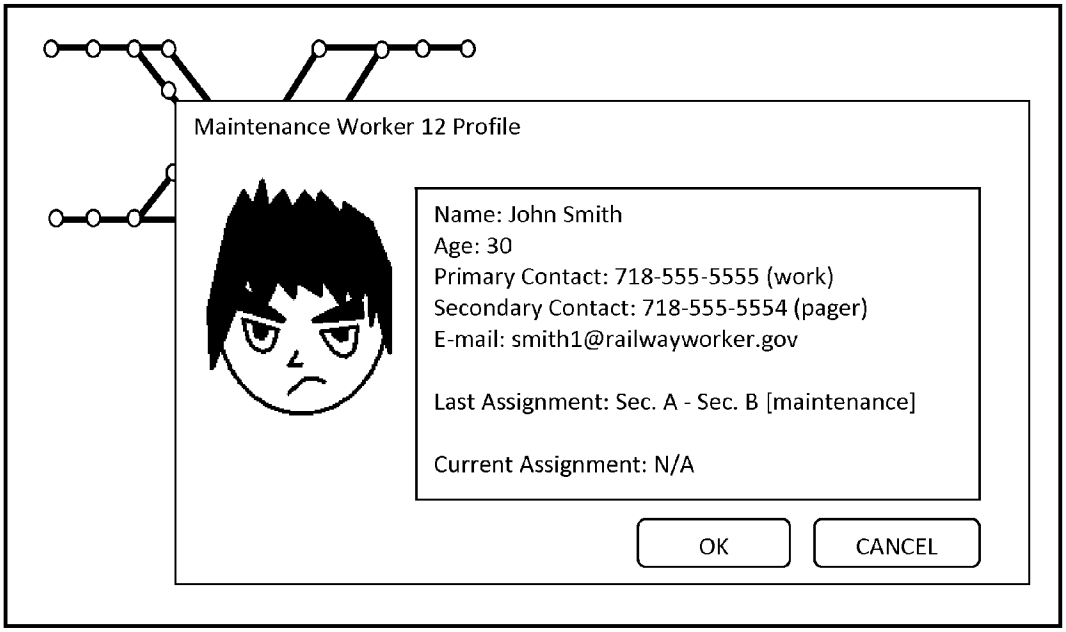


FIGURE 11


Maintenance Worker 12 Profile
Name: John Smith
Age: 30
Primary Contact: 718-555-5555 (work)
Secondary Contact: 718-555-5554 (pager)
E-mail: smith1@railwayworker.gov
Last Assignment: Sec. A - Sec. B [maintenance]
Current Assignment: N/A
OK
CANCEL

(Amended) **FIGURE 12**

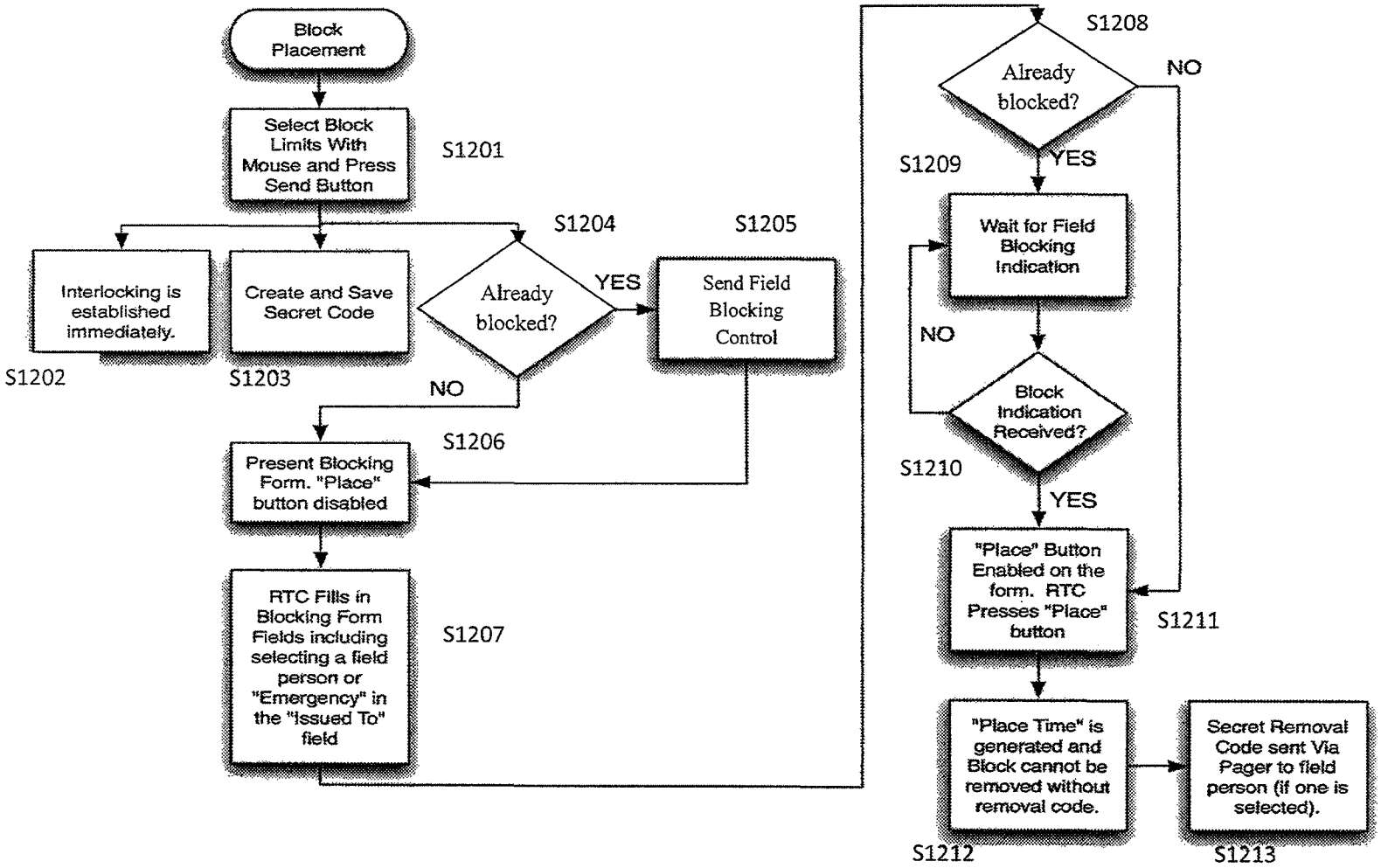
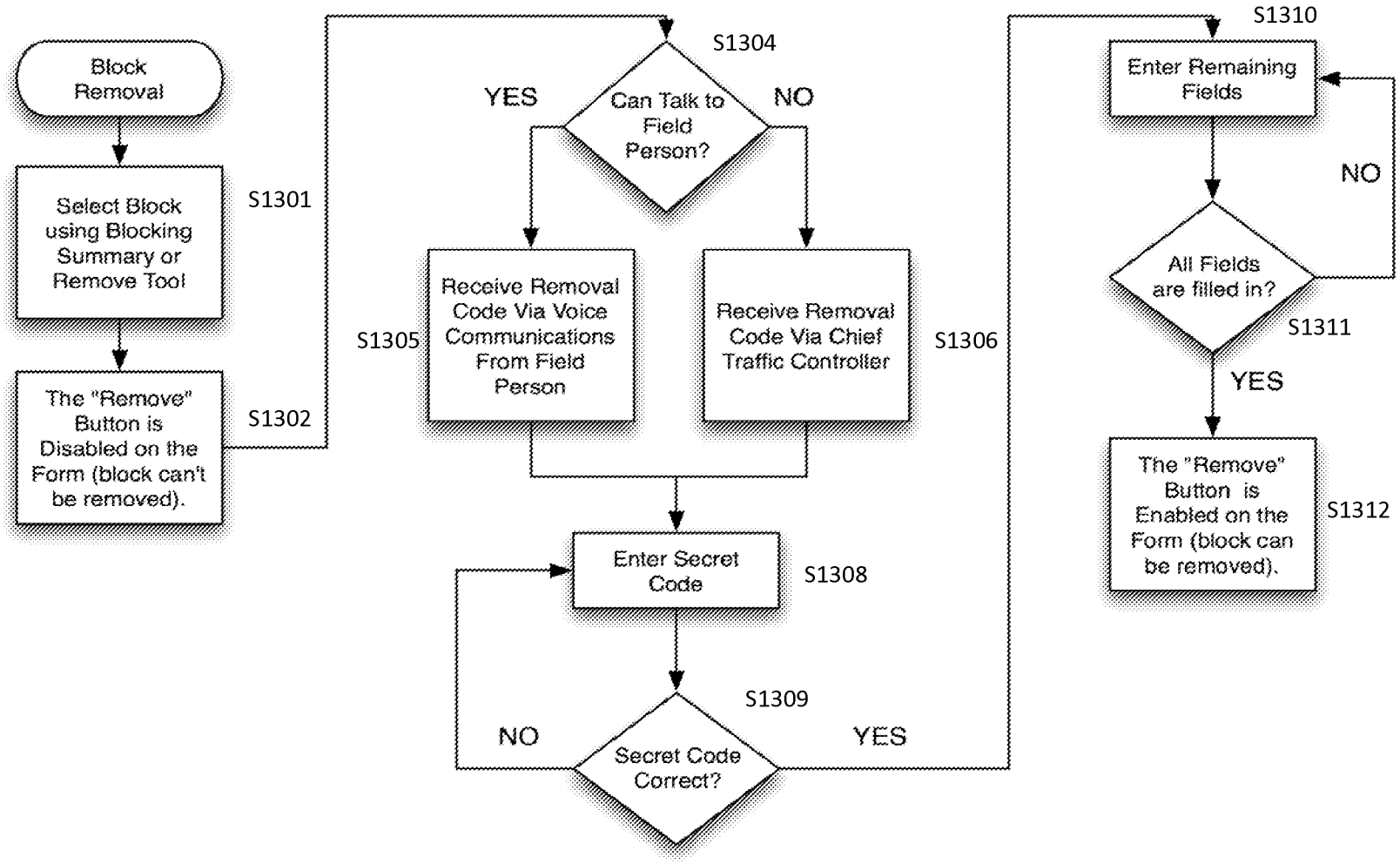


FIGURE 13


Block Removal
Select Block using Blocking Summary or Remove Tool
S1301
The "Remove" Button is Disabled on the Form (block can't be removed).
S1302
S1304
Can Talk to Field Person?
YES
NO
Receive Removal Code Via Voice Communications From Field Person
S1305
Receive Removal Code Via Chief Traffic Controller
S1306
Enter Secret Code
S1308
S1309
Secret Code Correct?
NO
YES
S1310
Enter Remaining Fields
All Fields are filled in?
NO
S1311
YES
The "Remove" Button is Enabled on the Form (block can be removed).
S1312

TOOLS FOR RAILWAY TRAFFIC CONTROL

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED [APPLICATION] *APPLICATIONS*

[This application] *Notice: The following multiple reissue applications have been filed for reissue of U.S. Pat. No. 9,403,545:*

(1) Reissue application Ser. No. 15/928,955 filed on Mar. 22, 2018 and reissued as U.S. Reissue Pat. No. RE47,835;

(2) This Reissue application Ser. No. 16/709,126, filed on Dec. 10, 2019, which is a reissue continuation of Reissue application Ser. No. 15/928,955.

U.S. Pat. No. 9,403,545 claims the benefit of U.S. Provisional Application No. 61/893,547, filed Oct. 21, 2013 and entitled "SYSTEM, APPARATUS AND METHOD FOR RAILWAY TRAFFIC CONTROL".

TECHNICAL FIELD

This disclosure relates to railway traffic control, and more specifically, a system, apparatus, and method for railway traffic control to address concerns for safety of railway workers working on or near railroad tracks.

BACKGROUND

Railway transportation is run under strict operational guidelines or rules, in order to operate safely. Most of these guidelines are standard amongst commercial railway traffic. Examples of transport standards include interlock signals, centralized traffic control (CTC), rule 251, etc.

Interlocking signals govern movement within a sector controlled by an interlock. For example, on a specific track line, a track may be divided into sections of 400 to 2500 m, on each of which trains move at a speed depending on an interlocking signal exhibited by an interlock at an entrance to the section. That is, the interlocking signal displays a color system which instructs the conductor of the train, or the train operating by automated response, how to move through the upcoming section of track. Interlocking systems usually incorporate a 3-color system by which the train, or train conductor, is informed to proceed at regular speed, is informed to proceed at a reduced speed or is prohibited from proceeding through the upcoming section.

While interlocking systems can be operated manually, currently most interlocking systems are controlled electronically. One method of controlling all of the interlocks within a rail system is through a centralized traffic control (CTC), or traffic control system (TCS). A CTC is used for monitoring, tracking and operating trains traversing tracks throughout a network. The CTC is controlled by a single person known as a train dispatcher.

In order for the train dispatcher to make appropriate train control decisions regarding how the train should be operated, various information and data must be obtained and presented. Information regarding track conditions, train traffic, scheduling, etc., are presented on a control console which may include a map of the entire rail system controlled

by the CTC. Through the control console, the dispatcher has control of each interlock signal (that is, the dispatcher controls the train traffic and flow of train traffic using the interlocks) and is constantly made aware of the positions of trains in the railway system as such positions are electronically reported by signals present throughout the railway system. In addition, in order to provide for safe traffic control and avoid accidents or collisions, signals are provided throughout the track network, or interlocks.

The interlocks may be controlled from the CTC in any of various different ways, including, e.g., direct wiring, by pulse codes sent over a wire to distant locations, etc. In addition, interlocks can also be controlled by a native mechanism detecting presence of a train on the track. That is, when a train occupies a certain section of track, the interlock prevents other trains from proceeding onto the same

Further, there are additional safety systems on the train itself, such as automatic train control (ATC). A common feature of many of such automated train control systems is the need for constant or nearly constant communications between onboard train control systems and an offboard hub radio connected to control equipment located along the wayside or in a central office. In some systems, the offboard control equipment generates movement authorities which authorize the train to move in one or more sections of track. In some systems, the offboard equipment informs the onboard train control system of the presence of other trains in the vicinity. In yet other systems, the offboard equipment provides information such as temporary speed restrictions and work zone information to the onboard train control system. Such systems protect against a number of human errors on the part of the train drivers, one of the basics of the system being that the train is provided with a computer which receives traffic information, such as stop signals and speed limits, from a plurality of transmitters along the track. Thus, the computer may bring the train to a standstill regardless of what the train driver does when the train arrives at a stop signal.

Even with all these safety features present in a railway system, railway accidents occur, with many being fatal. For example, one study reported that there were 39 roadway worker accidents that occurred between January 1997 and the end of 2011, in which 41 roadway workers perished while attending to tasks such as inspection, construction, maintenance, or repair of railroad track, bridges, roadway, signal and communication systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near track, operating as flagmen or watchmen/lookouts for other roadway workers, etc.

There remains a need for further safety measures to protect the lives of railway workers.

BRIEF SUMMARY

This disclosure provides tools (in the form of systems, apparatuses, methodologies, etc.) for enhancing railway traffic control, as supplemental measures directed to safety of railway workers.

For example, a centralized railway control system may be adapted (such as via computer hardware, software, or a combination) to include providing on a user terminal a user interface including a block placing part to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections, generating a removal code and transmitting the removal code to the electronic contact

address of the railway field worker, and permitting the block to the track sections to be removed only upon entry of the removal code in the centralized railway control system. Such process may be largely automated via programming such that upon placement, by the block placing part, of the block of railway traffic to the specified track sections, the removal code is automatically transmitted, by a code generation part, to the electronic contact address of the railway field worker, and the block of railway traffic to the specified track sections remains in place in the centralized railway control system until the entry of the removal code in the centralized railway control system to cause a block removal part to remove the block on said one or more track sections.

In another aspect, the adaptation may include a RTC user interface to permit a user (e.g., *railway traffic controller* (*RTC*) *or* train dispatcher) to specify a track section(s) to be blocked, specify an instruction to the centralized railway control system to block the railway traffic to the specified track section(s), and specify identifying information of the railway field worker performing (or to be performing) work in the specified track section(s).

In another aspect, the adaptation includes a block removal user interface to permit a user to enter the removal code to cause the block removal part to remove the block on said one or more track sections. Such block removal user interface may be provided in any of various ways. For example, the block removal user interface may be provided within a mobile application or web page through which the railway field worker can enter the removal code manually or orally (i.e. including a voice or speech interface part). As another example, the removal code may be embedded in a link in a message transmitted by email or messaging to the electronic contact address of the railway field worker, and the railway field worker can simply cause the removal code to be entered by activating the link in the message received by the railway field worker. In another example, the block removal user interface may be provided on the same user terminal on which the block placing part is disposed. Further, a voice or speech interface part may be disposed on the system-side to process a voice message (such as received via a telephone call from the railway field worker, extract the removal code from the voice message, and enter the block removal code. In each instance, the block of railway traffic to the specified track sections remains in place in the centralized railway control system until the entry of the removal code through the block removal user interface. Further, entry of the removal code may also require entry of identification of the user entering the removal code, and removal of the block may also require not only the removal code but also confirmation that the user entering the removal code is authorized to remove the block. The block removal user interface may further require, in addition to entry of the removal code, the user to specify that confirmation that the track sections have been cleared has been obtained from the railway field worker associated with the block, before the block removal user interface permits the removal code to be transmitted to the block removal part.

In another aspect, the system may include a railway control database registering block identifying information, including block limits identifying the one or more blocked track sections, along with the removal code for removing the block of the track sections. Further, the railway control database may register additional information, such as identification of the user who specified the instruction to block the track sections, notes specifying reasons for the block, date and time at which the block was placed, etc. The railway control database may further register block removal information identifying date and time at which the block was removed and identifying the user who entered the removal code and who specified that confirmation that the track sections have been cleared was obtained from the railway field worker associated with the block.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned and other aspects, features and advantages can be more readily understood from the following detailed description with reference to the accompanying drawings wherein:

FIG. **1**A shows a block diagram illustrating a railway control system, in accordance with an exemplary embodiment;

FIG. **1**B shows a block diagram illustrating a railway control system, in accordance with another exemplary embodiment;

FIG. **2** shows a block diagram of a railway traffic control apparatus, in accordance with an exemplary embodiment;

FIG. **3**A shows a block diagram of an exemplary configuration of a terminal;

FIG. **3**B shows a block diagram of an exemplary configuration of a computing device;

FIG. **4** shows a schematic diagram illustrating communication flow in the system shown in FIG. **1**A or in the system shown in FIG. **1**B;

FIG. **5** shows an example of a graphical portrayal of a railway network;

FIGS. **6-9** show examples of a user interface display, in accordance with an exemplary embodiment;

FIG. **10** shows an example of a user interface display that may be provided on the field worker side for triggering block removal;

FIG. **11** shows another example of a user interface display;

FIG. **12** shows a flow chart illustrating a block placement method, in accordance with an exemplary embodiment;

FIG. **13** shows a flow chart illustrating a block removal method, in accordance with an exemplary embodiment;

DETAILED DESCRIPTION

This patent specification describes tools (in the form of methods, apparatuses and systems) that controls train traffic within a railway system using, but not limited to, standardized rules or timetables described in the Background section of this specification.

In describing exemplary embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the subject matter of this patent specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner.

The drawings show examples of implementations of the subject matter of this patent disclosure in several computing environments. However, it should be understood that the subject matter of this disclosure can be utilized by any computing device including but not limited to PDAs (*personal digital assistants*), cell phones, personal, notebook and workstation computers, kiosks, other information terminals, [WIC (or another)] pager, etc. In addition, the subject matter of this disclosure might be provided as services in a modular fashion by other devices connected by a communication network.

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, there is described tools (systems, apparatuses, methodologies, computer program products, etc.) that can be integrated in a railway traffic control system.

FIG. **1**A shows schematically an exemplary embodiment in which a system **100**A includes a railway traffic control *apparatus* (*i.e.,* terminal) **105**, rail personnel data **104** and a terminal **103**, each connected to the network **102**. FIG. **1**B shows schematically another exemplary embodiment, in which rail personnel contact data **104** is accessed directly by the railway traffic control apparatus **105**. While only one terminal *103* is connected to the network **102** in the example shown in FIG. **1**A as well as in the example shown in FIG. **1**B, it should be appreciated that the network environment can have an arbitrary number of devices (of various types).

The network **102** can be any data network, a local area network, a wide area network or any type of network such as an intranet, an extranet (for example, to provide controlled access to external users, for example through the Internet), a private or public cloud network, the Internet, etc., or a combination thereof. Further, other communications links (such as a virtual private network, a wireless link, etc.) may be used as well for the network **102**. In addition, the network **102** preferably uses TCP/IP (Transmission Control Protocol/Internet Protocol), but other protocols such as SNMP (Simple Network Management Protocol) and HTTP (Hypertext Transfer Protocol) can also be used. How devices can connect to and communicate over networks is well-known in the art and is discussed for example, in "How Networks Work", by Frank J. Derfler, Jr. and Les Freed (Que Corporation 2000) and "How Computers Work", by Ron White, (Que Corporation 1999), the entire contents of each of which are incorporated herein by reference.

The rail personnel **104** is a database that can be either connected to or inside the railway traffic control terminal **105**. The rail personnel contact data **104** stores information regarding the maintenance workers used for traveling, inspecting and working on blocked rails. For example, the information stored can include name of the maintenance worker, primary contact, secondary contact, previous assignment, current assignment, etc. as shown via user interface display in FIG. **11**.

FIG. **2** shows a **[**terminal **100**A**]** *computer 200A* which is configured (such as via one or more programs of instructions executable by a processor **[**of a computer or another electronic device) with**]**) *to be* a railway traffic blocking apparatus **[101** to include**]** *105 including* a block placer **101**A, a code generator **101**B, a block remover **101**C and a user interface **101**D. The **[**terminal **100**A**]** *computer 200A* can be any electronic device including a processor, storage and display, such as shown by way of examples in FIGS. **3**A and **3**B.

The railway traffic blocking apparatus is programmed to control the traffic of an entire railway network. The block placer **101**A is configured to stop traffic within a certain length of rail line. That is, once a block is placed, no train can traverse the blocked section of rail. For example, in the case of a railway controlled by multiple interlocks, the block placer **101**A causes those interlocks to output a STOP signal, therefore, stopping any train traffic within the rails controlled by that interlock. By doing this, maintenance workers and railway personnel can travel, inspect and work on the rails without the danger of oncoming train traffic. Trains that are scheduled to traverse said blocked tracks either come to a complete stop, electronically or mechanically, before passing the interlock or are rerouted using tracks that are not in a blocked state. However, this disclosure is not limited to a railway traffic control system implementing interlocks. This system can be implemented on any configuration in which there is control of the traffic of a railway system.

The code generator **101**B is configured to produce a removal or release code, such as a cipher which is random, **[**pseudo-random,**]** secret, etc., and stored on the **[**terminal**]** *computer*. A new random cipher may be generated for each instance of traffic blocking. This removal or release code is then sent to **[**another terminal**]** *terminals* belonging to the railway personnel who are scheduled to travel, inspect or work on the specific rails being blocked.

The block remover **101**C is programmed to remove the previous block, or plurality of blocks set by the block placer **101**A. The block remover **101**C is dependent on the code produced by the code generator **101**B. As described in detail below, a block cannot be removed without the input of the removal or release code.

The user interface **101**D is configured preferably for the ease of use for the railway traffic controller (*RTC*). As shown by way of examples in FIGS. **6-9** and **11**, the user interface **101**D displays information and tools needed to enable/disable blocks on rail sections.

The user interface **101**D may be a mobile application, a web page or some other software component, on a terminal device. Such terminal preferably is configured to communicate through a computer or data network to obtain content and data from an external source. However, it should be appreciated that the inventive aspects described herein can be employed even if the mobile device is not configured to connect to a data network, and/or is not connected to a data network.

An example of a configuration of a user terminal (e.g., the terminal **103**) or computer is shown schematically in FIG. **3**A. In the example of FIG. **3**A, terminal device **200** includes a controller (or processor) **202** that communicates with a number of other components, including storage **203**, display **204**, input/output (such as mouse, touchpad, stylus, microphone and/or speaker with voice/speech interface and/or recognition software, etc.) **205** and a network interface **206**, by way of an internal bus **201**.

The storage **203** can provide storage for program and data, and may include a combination of assorted conventional storage devices such as buffers, registers and memories [for example, read-only memory (ROM), programmable ROM (PROM), erasable PROM (EPROM), electrically erasable PROM (EEPROM), static random access memory (SRAM), dynamic random access memory (DRAM), non-volatile random access memory (NOVRAM), etc.].

The network interface **206** provides a connection (for example, by way of an Ethernet connection or other network connection which supports any desired network protocol such as, but not limited to TCP/IP, IPX (*Internetwork Packet Exchange*), IPX/SPX (*Internetwork Packet Exchange/Sequenced Packet Exchange*), or NetBEUI (*NetBIOS Extended User Interface*)) to a network (e.g., network **102**) to enable the terminal device to communicate with another device through the network.

FIG. **3**B shows an exemplary constitution of a computer **300** which can be configured by appropriate programming to operate as the railway traffic control apparatus **105** (FIG. **1**A). The computer **300** shown in FIG. **3**B includes a processor **302**, and various elements connected to the processor **302** by an internal bus **301**, such as a memory **303**, display **304**, keyboard **305** and network interface **306**. The processor **302** processes incoming requests transmitted

through the network interface **306**. The network interface **306** enables the railway traffic control terminal to communicate with other network-connected devices such as a terminal (e.g., the terminal **103** of FIG. **1**A or FIG. **1**B) and receive data or service requests.

Each of the terminal **103**, rail personnel database **104** and railway traffic control apparatus **105** can be configured to communicate with each other through the network **102**. The railway traffic control terminal **105** can be configured to request data from the rail personnel contact data **104** through the network **102**, as shown in FIG. **4**. When the railway traffic control apparatus **105** initiates a block on a track section, the railway traffic control apparatus **105** may also designate a worker in associate with the block on the track section. With this information, the railway traffic control apparatus **105** requests the specific personnel data pertaining to the designated worker. The rail personnel contact data retrieves the requested personnel data and sends it to the railway traffic control apparatus **105**. By receiving this data, the railway traffic control apparatus **105** may then generate a release code and save it to an internal storage.

The release code is then sent to the terminal **[102]** *103*. This terminal **[102]** *103* is the contact associated with the designated worker, and the electronic address of this terminal is found within the personnel data received from the rail personnel contact data **104**. By this system, only the railway traffic control apparatus **105** and terminal **[102]** *103* receive the release code generated by the railway traffic control apparatus **105**.

Additionally, FIG. **4** shows the communication between the terminal **[102]** *103* and the railway traffic control apparatus **105** in the event that a block on a certain track is to be lifted. In order for a block on a certain track to be lifted, the release code has to be input into the railway traffic control apparatus. The terminal **[102]** *103* sends the release code to the railway traffic control apparatus **105**. The release code is then input into the block remover **101**C. After which, the block is removed and traffic to that section of rail is then allowed.

FIG. **5** illustrates an example of a railway network **500**. Labeled are interlocks A-F which control sections of railway of the railway network **500**. For example, the rail traffic controller (*RTC*) might choose to block the section of rail corresponding to the track between interlock A and interlock B. This way, train traffic between those two interlocks in prohibited. The railway network is present on screen of the railway traffic control terminal **105** at all times for the convenience of the rail traffic controller. By being on screen at all times, the rail traffic controller knows the status of certain sections of rail in real time.

As shown in the example illustrated in FIG. **5**, the railway between interlocks A and B, and interlocks C, D and E is blocked. Train traffic is prohibited between these sections and shown to the railway traffic controller on screen. As further explained below, the railway traffic controller can lift the blocks on these sections of track if the release code is input into the railway traffic control terminal **105**.

FIG. **6** is an exemplary illustration of the user interface of the railway traffic control terminal **105**. The railway traffic controller (*RTC*) may place blocks on any section of traffic using this user interface. In this exemplary embodiment, the train traffic controller inputs authority, worker and block limits. This information corresponds to the train traffic controller username, maintenance worker designated to work on the specific blocked track and the sections of track being blocked, respectively. In addition, the railway traffic control terminal **105** then timestamps the order once the block is placed.

Once the block is put into place, the corresponding section on the railway network **500** displays the section of track being blocked. In addition, the railway traffic control terminal **105** generates a release code, stores the release code, and sends the code to the maintenance worker designated for track work, i.e. maintenance worker 12. As shown in FIG. **6**, the railway traffic controller may place blocks on track sections but may not remove the track blocks without the input of the release code in the allotted area labeled release code. FIG. **6** shows that the remove action is dashed out, meaning it cannot be selected (unless a release code is first entered). In the example illustrated in FIG. **6**, it is shown that only one worker, maintenance worker 12 is designated to work on track Section A to Section B. However, as shown in later embodiments, the train traffic controller is not limited to the amount of maintenance workers designated for any track section. In addition, the train traffic controller may apply a block to any number of additional track sections.

The blocks are then tabulated by the railway traffic control apparatus **105** as depicted in FIG. **7**. The table in FIG. **7** lists all the blocks that are in place and in addition lists blocks that were previously set. The information that can be found in this table includes, but is not limited to, the type of work being done on the track sections, when the block was placed, who is designated to work on the sections of track, who placed the block, when was the block removed and who removed the block.

Additional information can be accessed though this table by highlighting a cell of the table and selecting info, as shown in FIG. **7**. For example, by highlighting the cell labeled maintenance worker 12 and selecting info, the train traffic controller may access the bio of the maintenance worker 12, as shown in detail below. The train traffic controller may also highlight a different cell, such as the limits cell label "Sec. A-Sec. B". By selecting this cell and selecting the info command, the past history of maintenance work and operation of the section(s) may be displayed to the train traffic controller.

FIG. **8** shows the user interface of the railway traffic control terminal **105** as the railway traffic controller inputs the release code to remove the block on certain track sections. In the exemplary embodiment of FIG. **8**, the remove option is now able to be selected with the input of the release code provided by the designated worker assigned for track work, maintenance worker 12.

Without the input of the release code, the remove option is not available to be selected. In a different embodiment, the release code may be obtained from the storage of the railway traffic control terminal **105**.

In the case where there are multiple maintenance workers assigned to a certain track section, there may be provided one release code to one, multiple or all of the maintenance workers assigned. That is, The train traffic controller may input that the release code be specified to one maintenance worker, preferably a supervisor or foreman, to multiple maintenance workers or to all of the maintenance workers assigned to work on a given track section. Also, in another embodiment, in a case where there are multiple workers assigned for a certain track section, there may be provided multiple unique release codes which would then all be required to be input into the train traffic control terminal **105** by the train traffic controller in order to be able to remove blocks on certain track sections.

In another embodiment, the train traffic controller may be asked to verify that a railway section is cleared before receiving the option to remove a train block. As shown in FIG. **9**, the user interface displayed by the railway traffic control terminal **105** does not allow a removal of a block until the option corresponding to "Railway Section Cleared" is checked. This option allows for a further protection of the maintenance workers assigned to the block track sections.

FIG. **10** shows an exemplary illustration of a message sent by the railway traffic control [terminal] *apparatus* **105** to a terminal **103** at a corresponding address of a maintenance worker assigned to work on a blocked track. The message is meant to deliver the release code to the maintenance worker assigned to work on a blocked track. In addition to relaying the code, the message may include, but not limited to, information regarding the section of track that is being blocked, the date and time that the track was blocked, who initiated the track block, and links to quickly respond to the message. By selecting one of the links embedded in the message, the terminal **103** sends the release code to the railway traffic control [terminal] *apparatus* **105**. The code can be transmitted through, but not limited to, text message, e-mail or voice message. In the present embodiment being illustrated, the terminal **103** is depicted as a mobile phone. The terminal **103** could be any communication device such as, but not limited to, mobile phone or smartphone, tablet, [WIC (or another)] pager, PDA, etc.

In another embodiment, once the rail traffic controller unblocks a section of track, the railway traffic control [terminal] *apparatus* **105** may send a message to the worker, or plurality of workers, associated with working on the previously blocked track in order to inform them that the track has been unblocked and is no longer a safe environment to work in.

FIG. **11** depicts an exemplary embodiment of a profile of a maintenance worker. This profile may be accessed directly by highlighting the corresponding maintenance worker cell in the table depicted in FIG. **7** and selecting the info tab. This command brings up the profile and the maintenance worker and displays information regarding the worker including, but not limited to, the name, age, primary contact, secondary contact, e-mail, last assignment and current assignment of the maintenance worker. Additionally in this screen, the railway traffic controller may contact the maintenance worker directly using one of the plurality of addresses provided.

Next, the method of placing a block on a track section will be described with reference to FIG. **12**. In S**1201**, the rail traffic controller selects the sections to be blocked using the railway traffic control terminal **105**. Once the block limits are designated and sent, the railway traffic control terminal **105** [established office] *establishes* interlocking immediately in S**1202**. That is, the railway traffic control terminal **105** immediately sends a signal to the corresponding interlocks corresponding to the section of track designated to be blocked. Additionally, the railway traffic control terminal **105** generates and saves a random secret code in S**1203**.

After a request to block a certain section of track is sent, the railway traffic control terminal **105** checks if there is one or more of the sections currently has a block placed, as shown in S**1204**. If one or more of the designated sections does not have a block placed, then the railway traffic control terminal **105** opens a user interface for the railway traffic controller to designate a type of block to set and a maintenance worker for the blocked section in S**1206**. If the railway traffic control terminal sees that a block is already in effect (S**1205**), then the railway traffic control terminal **105** allows the railway traffic controller to change the existing block type and maintenance worker using the same interface. The interface is then opened in S**1206**.

The railway traffic controller then inputs the type of block and assigns a worker to work on the blocked section. The railway traffic controller also has the option to block the track for purposes of an emergency and not necessarily for maintenance work in S**1207**. Once the railway traffic controller assigns a block type and/or a corresponding maintenance worker, the railway traffic control terminal **105** checks the status of the selected block in S**1208**. If the current selected section has an existing block, the railway traffic control terminal **105** waits for a response from the interlocks of the corresponding section to send an indication that a new block can be established in S**1209**. Once this indication is received in S**1210**, the railway traffic control terminal **105** enables the place button of the user interface (S**1211**). If the selected section has no previous active block, the railway traffic control terminal **105** immediately enables the place button on the user interface.

Once the place button is selected, the railway traffic control terminal **105** generates a place time and enables safety measures so that the block cannot be removed without the input of the secret code generated (S**1212**). Finally, the railway traffic control terminal **105** sends the secret removal code to the corresponding one or more maintenance workers (*S1213*) if the railway traffic controller has selected maintenance workers for the given block.

FIG. **13** describes a method for removing a block placed on a section of track. In S**1301**, the railway traffic controller selects an existing block by using either the network rail map, shown in FIG. **5**, the remove tool, shown in FIGS. **6**, **8** and **9**, or the summary table, shown in FIG. **7**. The remove button is disabled without the input of the secret code from either the maintenance worker or the railway traffic control terminal **105** (S**1302**). In S**1304**, the railway traffic control terminal **105** checks if there is a maintenance worker that is eligible to transmit the random secret code. If there is an eligible maintenance worker available (S**1304**, YES), the maintenance worker transmits the random secret code to the railway traffic control center **105** (S**1305**). If there is no maintenance worker available to transmit the random secret code (S**1304**, NO), the code can be retrieved from the train traffic control terminal **105** by the train traffic controller (S**1306**).

Once the secret code is received, the secret code may be input to the designated field in S**1308**. The railway traffic control terminal **105** checks the secret code with the code saved in its memory in S**1309**. If the code is incorrect, (S**1309**, NO), the railway traffic control terminal **105** will prompt the user to input the code again (S**1308**). If the code is correct (S**1309**, YES), the railway traffic control terminal will prompt the user to enter information into any remaining fields in S**1310**. In S**1311**, the railway traffic control terminal **105** checks that all information input into all fields is correct and that all fields are filled in. After this check is performed by the railway traffic control terminal **105**, the remove button is enabled on the form (S**1312**) and the railway traffic controller may remove the block on the corresponding track section.

The aforementioned specific embodiments are illustrative, and many variations can be introduced on these embodiments without departing from the spirit of the disclosure or from the scope of the appended claims. For example, elements and/or features of different examples and illustrative embodiments may be combined with each other

and/or substituted for each other within the scope of this disclosure and appended claims.

The orders in which the steps are performed in the aforementioned methods are not limited to those shown in the examples of FIGS. **12** and **13**, and may be switched as long as similar results are achieved. Also, it should be noted that the methods illustrated in the examples of FIGS. **12** and **13** may be implemented using any of the embodiments shown in FIGS. **1**A-**1**B.

Further, conventional systems can be modified to include the aspects described herein. As an example, a means may be added to a conventional interlock system by which the railway worker has partial control of the interlock system at the times that maintenance work is needed on a certain train block. In such modification, a system, apparatus and/or method may be provided to control the interlocks in a railway system as an interface between the railway workers and the interlock control. Thus, in a case in which maintenance is to be performed on a certain rail block, which is controlled by an interlock, the interlock can be configured to send out a stop signal for all incoming trains, to block train traffic to such portion of the rail system. In addition, once the interlock is placed in a "stop traffic" state, a release code is transmitted to an electronic contact address corresponding to the railway worker.

Once a block has been placed, the interlock remains in a blocked state, until the maintenance worker supplies the release code, which was received at the time the interlock started, and the release code is entered in the interlock control system. So long as the block is in place, the maintenance worker can perform on-track work, without interference of oncoming train traffic. After the maintenance worker finishes the assigned work and is clear of the train tracks, he/she may then supply the interlock control system with the release code, and the interlock control system in turn can release the interlock over the block.

Accordingly, the railway worker has more control over the traffic through the rail block in which the worker is working, and fatal on-track accidents can be reduced.

Additional variations may be apparent to one of ordinary skill in the art from reading U.S. Provisional Application No. 61/893,547, filed Oct. 21, 2013 and entitled "SYSTEM, APPARATUS AND METHOD FOR RAILWAY TRAFFIC CONTROL", the entire contents of which are incorporated herein by reference.

What is claimed is:

[**1**. A centralized railway control system comprising:

a rail personnel contact database registering, for each railway personnel, an electronic contact address of the railway personnel; and

a railway traffic control apparatus for controlling access to railway tracks, said railway traffic control apparatus comprising a processor, a non-transitory medium storing one or more programs of executable instructions, and a network interface through which the railway traffic control apparatus communicates via a network with a user terminal,

wherein execution of said one or more programs of executable instructions configures the processor to include:

a block placing part to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

a code generation part to generate a removal code, retrieve the electronic contact address of the railway field worker from the rail personnel contact database, and transmit the removal code to the electronic contact address of the railway field worker; and

a block removal part to remove only upon entry of the removal code, the block placed by the block placing part on said one or more track sections.]

[**2**. The centralized railway control system of claim **1**, wherein the railway traffic control apparatus further comprises:

a RTC user interface to permit a user to specify said one or more track sections to be blocked, specify an instruction to the centralized railway control system to block the railway traffic to the specified track sections, and specify identifying information of the railway field worker to be performing work in the specified track sections.]

[**3**. The centralized railway control system of claim **1**, further comprising:

a railway control database registering block identifying information, including block limits identifying the one or more blocked track sections, along with the removal code for removing the block of the track sections.]

[**4**. The centralized railway control system of claim **1**, further comprising:

a railway control database registering (a) identification of the user who specified the instruction to block the track sections and (b) block identifying information, including block limits identifying the one or more blocked track sections, notes specifying reasons for the block, and date and time at which the block was placed.]

[**5**. The centralized railway control system of claim **1**, wherein upon placement by the block placing part of the block of railway traffic to said one or more specified track sections, the code generation part transmits the removal code to the electronic contact address of the railway field worker, and the block of railway traffic to said one or more specified track sections remains in place in the centralized railway control system until the entry of the removal code in the centralized railway control system to cause the block removal part to remove the block on said one or more track sections.]

[**6**. The centralized railway control system of claim **1**, wherein the railway traffic control apparatus further comprises:

a block removal user interface to permit a user to enter the removal code to cause the block removal part to remove the block on said one or more track sections,

wherein the block of railway traffic to said one or more specified track sections remains in place in the centralized railway control system until the entry of the removal code through the block removal user interface.]

[**7**. The centralized railway control system of claim **6**, wherein the block removal user interface further requires, in addition to the entry of the removal code, the user to specify that confirmation that the track sections have been cleared has been obtained from the railway field worker associated with the block, before the block removal user interface permits the removal code to be transmitted to the block removal part, and

the centralized railway control system further comprises a railway control database registering (a) block identifying information identifying the one or more blocked track sections, date and time at which the block was placed and identifying information the railway field worker associated with the block, and (b) block removal information identifying date and time at which the block was removed and identifying the user who

entered the removal code and specified that confirmation that the track sections have been cleared was obtained from the railway field worker associated with the block.]

[8. The centralized railway control system of claim 1, further comprising:

a voice processing part configured to receive a voice message and extract the removal code from the voice message.]

[9. The centralized railway control system of claim 1, wherein the code generation part transmits an electronic message to the electronic contact address of the railway field worker, and the electronic message transmitted to the electronic contact address of the railway field worker includes the removal code and includes an embedded link for activating a return transmission of the removal code to the block removal part of the centralized railway control system.]

[10. A railway traffic control apparatus for controlling access to railway tracks, said railway traffic control apparatus comprising:

a block placing part to place a block on one or more selected track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

a code generation part to generate a removal code, determine an electronic contact address of the railway field worker by accessing a rail personnel contact database registering, for each railway personnel, electronic contact information of the railway personnel, and transmit the removal code to the electronic contact address of the railway field worker; and

a block removal part to remove only upon entry of the removal code, the block placed by the block placing part on said one or more track sections for the railway field worker.]

[11. The railway traffic control apparatus of claim 10, further comprising:

a RTC user interface to permit a user to specify said one or more track sections to be blocked, specify an instruction to the centralized railway control system to block the railway traffic to the specified track sections, and specify identifying information of the railway field worker to be performing work in the specified track sections.]

[12. The railway traffic control apparatus of claim 10, wherein block identifying information, including block limits identifying the one or more blocked track sections, is registered in a railway control database, along with the removal code for removing the block of the track sections.]

[13. The railway traffic control apparatus of claim 10, wherein block identifying information, including block limits identifying the one or more blocked track sections, notes specifying reasons for the block, and date and time at which the block was placed, are registered in a railway control database, along with identification of the user who specified the instruction to block the track sections.]

[14. The railway traffic control apparatus of claim 10, wherein upon placement by the block placing part of the block of railway traffic to said one or more specified track sections, the code generation code transmits the removal code to the electronic contact address of the railway field worker, and the block of railway traffic to said one or more specified track sections remains in place in the centralized railway control system until the entry of the removal code in the centralized railway control system to cause the block removal part to remove the block on said one or more track sections.]

[15. The railway traffic control apparatus of claim 10, further comprising:

a block removal user interface to permit a user to enter the removal code to cause the block removal part to remove the block on said one or more track sections,

wherein the block of railway traffic to said one or more specified track sections remains in place in the centralized railway control system until the entry of the removal code through the block removal user interface.]

[16. The railway traffic control apparatus of claim 15, wherein the block removal user interface further requires, in addition to the entry of the removal code, the user to specify that confirmation that the track sections have been cleared has been obtained from the railway field worker associated with the block, before the block removal user interface permits the removal code to be transmitted to the block removal part, and

block identifying information identifying the one or more blocked track sections, date and time at which the block was placed and identifying information the railway field worker associated with the block is registered in a railway control database, along with block removal information identifying date and time at which the block was removed and identifying the user who entered the removal code and specified that confirmation that the track sections have been cleared was obtained from the railway field worker associated with the block.]

[17. The railway traffic control apparatus of claim 10, further comprising:

a voice processing part configured to receive a voice message and extract the removal code from the voice message.]

[18. The railway traffic control apparatus of claim 10, wherein the code generation part transmits an electronic message to the electronic contact address of the railway field worker, and the electronic message transmitted to the electronic contact address of the railway field worker includes the removal code and includes an embedded link for activating a return transmission of the removal code to the block removal part of the centralized railway control system.]

[19. A method for a centralized railway control system to control access to railway tracks, the method comprising:

providing a user interface on a user terminal including a block placing part to place a block on one or more specified track sections to permit a railway field worker to enter the track sections while blocking railway traffic to said track sections;

generating a removal code, determining an electronic contact address of the railway field worker by accessing a rail personnel contact database registering, for each railway personnel, electronic contact information of the railway personnel, and transmitting the removal code to the electronic contact address of the railway field worker; and

permitting the block to said one or more track sections to be removed only upon entry of the removal code in the centralized railway control system.]

20. A railway control apparatus for centralized control of a centrally controllable railway network including plural railways and a plurality of railway interlocks dispersed in said plural railways, comprising:

a processor for controlling a plurality of track sections in the railway network, wherein each track section is associated with a corresponding interlock and is disposed in any of said plural railways of said railway

network that is managed by centralized control operation from the railway control apparatus, the processor controlling, by said centralized control operation, one or more interlocks amongst the plurality of railway interlocks dispersed in said plural railways of said railway network, to block railway traffic to one or more specified track sections; and

a memory device storing computer-executable instructions, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to:

receive a selection of at least one track section amongst the plurality of track sections;

transmit a block signal to the corresponding interlock associated with the at least one selected track section, to place a block on the selected track section by said centralized control operation from the railway control apparatus;

generate a secret code associated with the at least one selected track section; and

transmit the secret code to a remote user terminal.

21. The railway control apparatus of claim 20, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to store the secret code in the memory device.

22. The railway control apparatus of claim 21, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to:

receive a second secret code;

determine that the second secret code and the secret code stored in the memory device are the same; and

responsive to determining that the second secret code and the secret code stored in the memory device are the same, release the block on the at least one selected track section.

23. The railway control apparatus of claim 21, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to:

receive a second secret code;

determine that the second secret code and the secret code stored in the memory device are not the same; and

responsive to determining that the second secret code and the secret code stored in the memory device are not the same, maintaining the block on the at least one selected track section.

24. The railway control apparatus of claim 20, wherein the secret code is transmitted to the remote user terminal by messaging or email.

25. The railway control apparatus of claim 20, wherein the remote user terminal is a mobile phone, a smartphone, a tablet computer, a pager, or a personal digital assistant, and execution of the computer-executable instructions by the processor causes the railway control apparatus to transmit the secret code to said mobile phone, smartphone, tablet computer, pager, or personal digital assistant.

26. The railway control apparatus of claim 20, further comprising:

a network interface, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to transmit the secret code to the remote user terminal via the network interface.

27. The railway control apparatus of claim 20, wherein only the railway control apparatus and the remote user terminal receive the secret code.

28. The railway control apparatus of claim 20, wherein the secret code is generated by a random process.

29. The railway control apparatus of claim 20, further comprising:

a rail personnel database comprising information related to a plurality of rail personnel;

wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to:

retrieve specific personnel data from the rail personnel database; and

determine an electronic address of the remote user terminal to which the secret code is to be transmitted.

30. A railway control apparatus comprising:

a processor for controlling a plurality of track sections in a railway network, wherein each track section is associated with a corresponding interlock; and

a memory device storing computer-executable instructions, wherein execution of the computer-executable instructions by the processor causes the railway control apparatus to:

receive a selection of at least one track section amongst the plurality of track sections;

responsive to receiving the selection of the at least one track section, determine that the at least one selected track section has an existing block;

receive a signal from the corresponding interlock of the at least one selected track section that a new block can be established;

responsive to receiving the signal that a new block can be established, transmit a block signal to the corresponding interlock associated with the at least one selected track section, to place a block on the at least one selected track section;

generate a secret code associated with the at least one selected track section; and

transmit the secret code to a remote user terminal.

31. A method comprising:

receiving, by a processor, a selection of at least one selected track section in a centrally controlled railway network, wherein each track section corresponds to an interlock;

responsive to receiving the selection of the at least one selected track section, determining, by the processor, that the at least one selected track section has an existing block;

receiving, by the processor, a signal from the corresponding interlock of the at least one selected track section that a new block can be established;

responsive to receiving the signal that a new block can be established, transmitting, by the processor, a block signal to the corresponding interlock of the selected at least one selected track section to place a block on the selected at least one selected track section;

generating, by the processor, a secret code associated with the selected at least one selected track section;

transmitting, by the processor, the secret code to a remote user terminal.

32. The method of claim 31, further comprising:

storing the secret code in a memory device.

33. The method of claim 32, further comprising:

receiving, by the processor, a second secret code;

determining, by the processor, that the second secret code and the secret code stored in the memory device are the same; and

responsive to determining that the second secret code and the secret code stored in the memory device are the

same, releasing, by the processor, the block on the selected at least one selected track section.

34. The method of claim 32, further comprising:

receiving, by the processor, a second secret code;

determining, by the processor, that the second secret code and the secret code stored in the memory device are not the same; and

responsive to determining that the second secret code and the secret code stored in the memory device are not the same, maintaining the block on the selected at least one selected track section.

35. The method of claim 31, wherein only the processor and the remote user terminal receive the secret code.

36. The method of claim 31, further comprising:

retrieving, by the processor, specific personnel data from a rail personnel database; and

determining, by the processor, an electronic address of the remote user terminal to which the secret code is to be transmitted.

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