



(19) **United States**

(12) **Patent Application Publication**

Fernandez et al.

(10) **Pub. No.: US 2004/0104311 A1**

(43) **Pub. Date:**

Jun. 3, 2004

(54) **SYSTEM TO PROVIDE ENHANCED SECURITY AND CONTROL OF LOCOMOTIVES AND TRAINS**

Publication Classification

(51) **Int. Cl.⁷** **B61L 3/00**
(52) **U.S. Cl.** **246/167 R**

(75) **Inventors:** **Emilio A. Fernandez**, McLean, VA (US); **Robert P. Haag**, Frederick, MD (US)

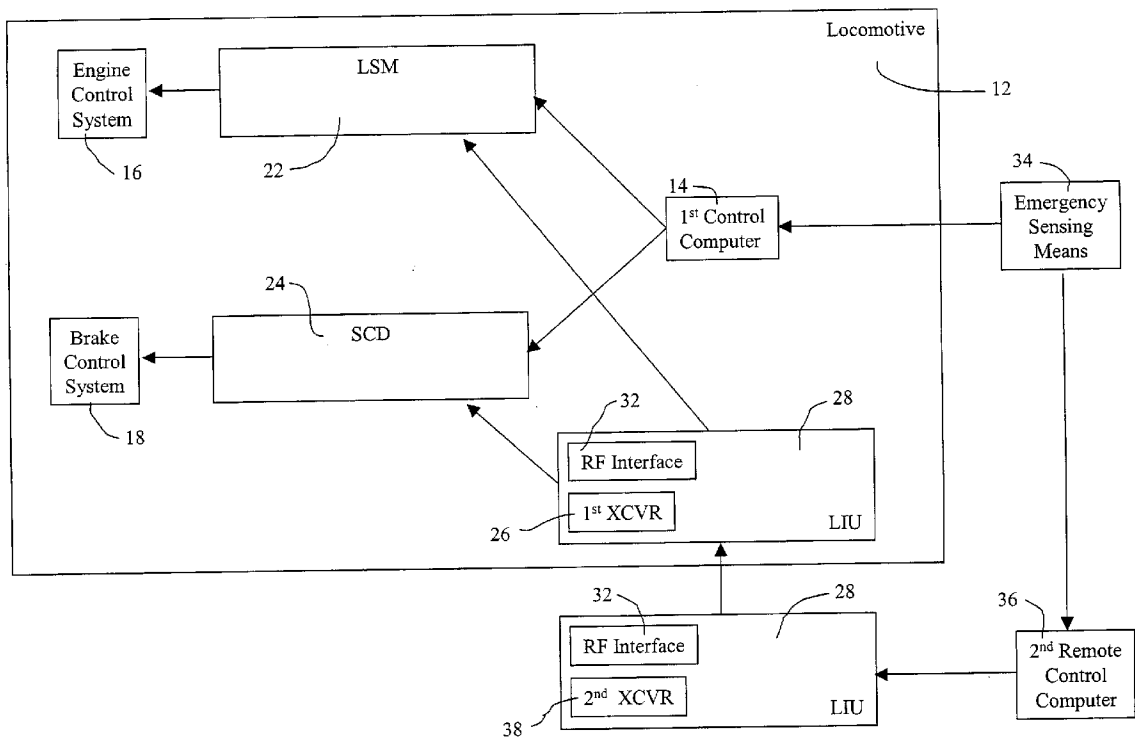
Correspondence Address:
Russell D Orkin
700 Koppers Bldg
436 Seventh Ave
Pittsburgh, PA 15219-1818 (US)

(73) **Assignee:** **WESTINGHOUSE AIR BRAKE TECHNOLOGIES CORPORATION**

(21) **Appl. No.:** **10/308,252**
(22) **Filed:** **Dec. 2, 2002**

(57) **ABSTRACT**

An approach to remotely shutting down and stopping a train consist would allow for increased safety and security of locomotives. A locomotive Security Module (LSM), a Security Control Device (SCD), a transceiver, an engine control system, and a brake control system would be mounted directly to each locomotive. Associated remotely with these devices would be a transceiver, a control computer, and a locomotive interface unit (LIU). The LSM is connected to the locomotive's engine control system, and the SCD is interconnected with the locomotive's braking system in a manner that when remotely triggered either an emergency braking application or an emergency engine shutdown will occur. Wherein enhancing the overall safety and security of a train consist is achieved.



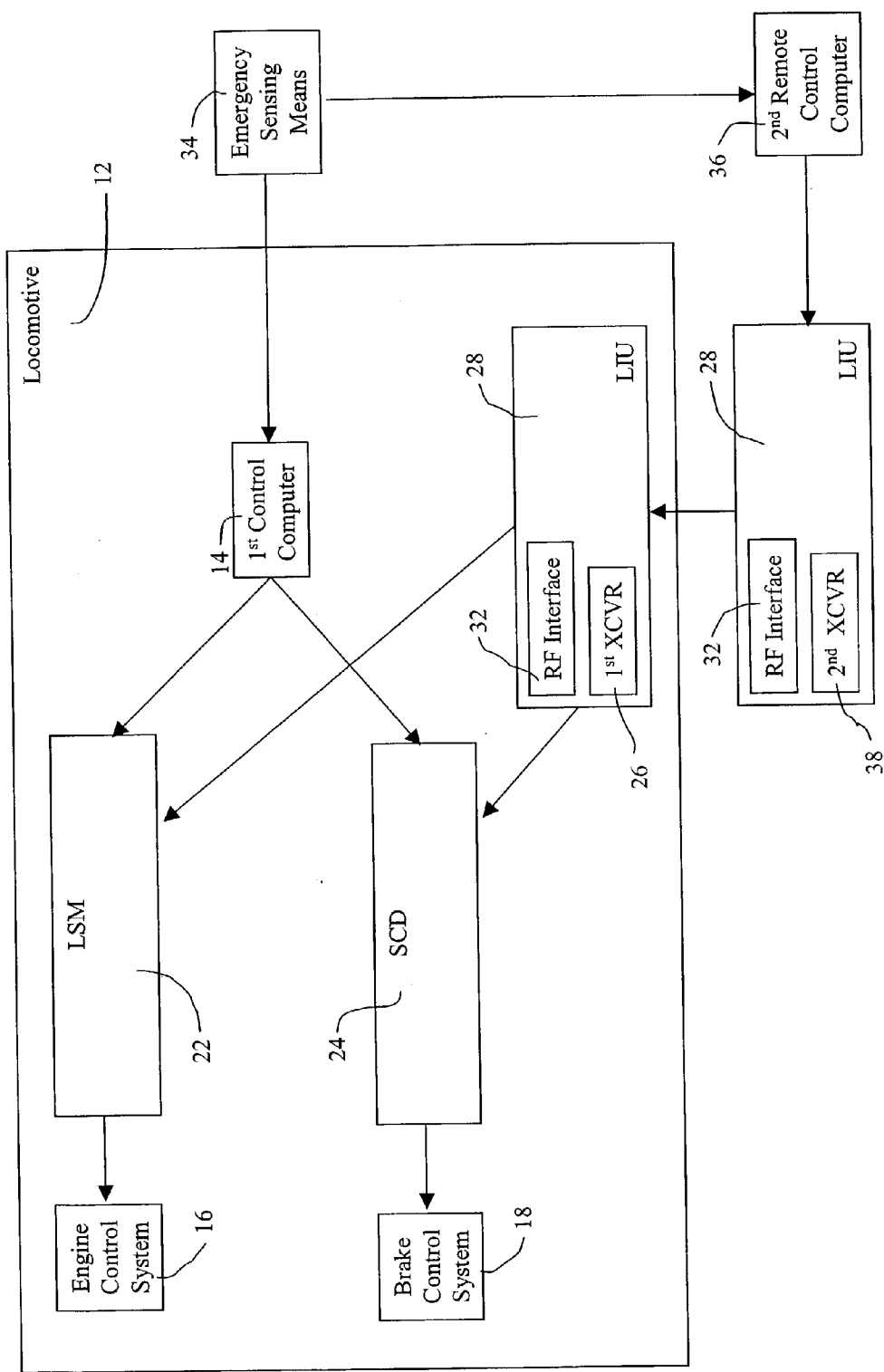


Figure 1

SYSTEM TO PROVIDE ENHANCED SECURITY AND CONTROL OF LOCOMOTIVES AND TRAINS

FIELD OF THE INVENTION

[0001] The present invention generally relates to security systems and, more particularly, this invention relates to security for a train consist having at least one locomotive. Still more particularly, this invention relates to a system for at least one of remotely shutting down and stopping a train consist when an emergency condition exists.

BACKGROUND OF THE INVENTION

[0002] A braking system is a critical part in the security and control, of the overall operation, of a train consist. The braking system, for a train consist, includes at least one locomotive having a compressor disposed thereon, a plurality of railcars, and a pneumatic trainline known as the "brake pipe". As taught in U.S. Pat. No. 6,195,600, the brake pipe is the means by which brake commands are pneumatically conveyed from the lead locomotive to each of the railcars in the train. The teachings of U.S. Pat. No. 6,195,600 are incorporated herein by reference thereto.

[0003] The brake pipe consists of a series of interconnected pipe lengths, with one pipe length secured to the underside of each railcar. The pipe length on each railcar is connected at each end to one end of an angle cock. Each angle cock is connected at its other end to one end of a hose, with the other end of the hose being connected to a glad hand.

[0004] A glad hand coupler is formed when the glad hands of adjacent railcars are coupled together. Coupling the glad hand of each railcar to the glad hand of the railcar or locomotive located thus forms the brake pipe of the train immediately adjacent to it. It is to the brake pipe of the train that the pneumatic brake equipment on each rail car connects via a branch pipe.

[0005] The locomotive itself has its own pneumatic trainlines including a main reservoir equalizing (MRE) pipe, an independent application and release (IAR) pipe, and an actuating pipe. Within a train consist the MRE, actuating and IAR pipes of each locomotive connect to the MRE, actuating and IAR pipes of adjacent locomotives.

[0006] As is now well known in the art, modern locomotives are equipped with electronic air brake equipment, such as the EPIC® 3102 or EPIC® II type brake control systems. These systems are produced by the Westinghouse Air Brake Technologies Corporation (WABTEC). Such equipment typically includes a cab control unit, a brake control computer, a pneumatic operating unit (POU), and a locomotive interface unit (LIU). Through a bank of input relays, the LIU conveys various input signals to the brake control computer. Through a bank of output relays in the LIU, the computer can provide various output signals to other equipment in the locomotive.

[0007] The cab control unit houses the automatic and independent brake handles and, generates various signals including those representing the positions of the brake handles. These signals are conveyed to the brake control computer. Based on the inputs it receives and the software that dictates its operation, the brake control computer controls the overall operation of the brakes. According to the

commands it receives, including those from the brake control computer, the POU affects the pressure in the IAR and brake pipes, as well as in other pneumatic trainlines, and thereby controls the brakes of the train consist.

[0008] By moving the automatic brake handle the operator can control the pressure level in the brake pipe and thereby direct whether, and to what extent, the brakes on both the locomotives and the railcars are applied. The automatic brake handle can be moved from and in between a release position at one extreme in which brake pipe pressure is at a maximum and the brakes are completely released to an emergency position at another extreme in which brake pipe pressure is zero and the brakes are fully applied. The automatic brake handle positions include release, minimum service, full service, suppression, continuous service, and emergency. Between the minimum and full service positions lies the service zone wherein each incremental movement of the automatic brake handle toward the full service position causes the pressure within the brake pipe to reduce incrementally. More specifically, moving the automatic brake handle causes the brake control computer to affect the operation of the BP control portion, which in turn, affects the pressure within the equalization reservoir of the locomotive whose pressure the brake pipe generally mimics. The pressure in the brake pipe, in turn, affects not only the operation of the brake control valve(s) on each railcar, but also the operation of the BC control portion in the locomotive.

[0009] Dependent on the position of the automatic brake handle, the pressure level within the brake pipe determines whether the brake control valve on each railcar will charge its reservoirs or deliver pressurized air previously stored in one or both of its reservoirs to the brake cylinders. By changing its pressure level using the automatic brake handle, the brake pipe is used to convey release, service, and emergency brake commands to the pneumatic brake equipment on each railcar in the train.

[0010] When the automatic brake handle is moved into the emergency position, the brake control computer commands the BP control portion to reduce pressure in the brake pipe. In addition, the brake equipment energizes two emergency magnet valves located in the BP control portion. The brake control computer energizes one emergency magnet valve, whereas the other emergency magnet valve is energized directly by a micro-switch that closes when the automatic brake handle is moved into the emergency position. Through these two emergency magnet valves, the BP control portion vents the brake pipe to atmosphere at an emergency rate via its emergency vent valve. In response to this emergency brake command, the service and emergency portions of each brake control valve supplies air from both reservoirs to the brake cylinders so as to apply the brakes of the railcar fully.

[0011] Another way to apply the train brakes in an emergency is by use of a dual-ported valve referred to as the conductor's valve. By moving the handle of this valve to the open position, the conductor's valve not only vents the brake pipe to atmosphere at an emergency rate but also allows air from the main reservoir of the locomotive to flow to, and thus close, an emergency pressure switch (EMPS). When closed, the EMPS provide battery voltage to one of the input relays of the LIU. It is through the EMPS input relaying the LIU signals the brake control computer that the emergency was initiated by the train operator, or by another person, located in the same compartment as the operator.

[0012] As stated, there are several on-board means for initiating an emergency braking application, as well as, for shutting down a train consist during an emergency condition. However, there is no present means of initiating an emergency condition signal to indicate the need for shutting down, or an emergency brake signal to initiate an emergency braking application for a train consist from a remote location. Being able to perform such operations from a remote location will significantly enhance the overall security and control of any train consist.

SUMMARY OF THE INVENTION

[0013] According to a first aspect, the present invention provides a method of at least one of automatically shutting down and stopping a train consist when an emergency condition exists. The method includes the steps of connecting a railway telemetry means for communication with a first control computer disposed on a locomotive. Connecting at least one predetermined emergency sensing means for communication with such railway telemetry means. Determining when at least one such emergency condition exists and generating at least one of an emergency condition signal and an emergency brake signal via the at least one predetermined emergency sensing means. Communicating at least one of such emergency condition signal and such emergency brake signal generated to the first control computer via such railway telemetry means. Utilizing the first control computer to generate at least one of an engine shut down command signal and an emergency brake command signal in response to at least one of such emergency condition signal and such emergency brake signal communicated as discussed above. Communicating at least one of such engine shut down command signal and the emergency brake command signal to an engine control system and a brake control system respectively and then at least one of automatically shutting down and stopping such train consist in response to at least one of such engine shut down command signal and such emergency brake command signal.

OBJECTS OF THE INVENTION

[0014] It is, therefore, a primary object of the present invention to provide enhanced security and control of a train consist, that automatically shuts down a train consist when an emergency condition signal exists.

[0015] Another object of this invention, to provide enhanced security and control of a train consist, is the ability to remotely identify if an emergency condition exists and generate a remote signal representative of the emergency condition.

[0016] Another object of this invention, to provide enhanced security and control of a train consist, is the ability to redundantly identify if an emergency condition exists and generating a remote signal representative of the emergency condition.

[0017] Yet another object of this invention, to provide enhanced security and control of a train consist, is to generate at least one remote engine shut down command signal for shutting down a train consist.

[0018] Yet another object of this invention, to provide enhanced security and control of a train consist, is to generate at least one redundant engine shut down command signal for shutting down a train consist.

[0019] Yet another object of this invention, to provide enhanced security and control of a train consist, that automatically stops a train consist when an emergency condition exists.

[0020] Yet another object of this invention, to provide enhanced security and control of a train consist, is the ability to identify if an emergency brake signal exists.

[0021] Yet another object of this invention, to provide enhanced security and control of a train consist, is the ability to remotely identify if an emergency condition exists and generating at least one remote signal representative of the emergency condition for stopping train consist.

[0022] Still another object of this invention, to provide enhanced security and control of a train consist, is the ability to redundantly identify if an emergency condition exists and generating at least one redundant signal representative of the emergency condition for stopping a train consist.

[0023] In addition to the above-described objects and advantages of the enhanced security and control of a train consist of this invention, various other objects and advantages of the present invention will become more readily apparent to those persons who are skilled in the same and related arts from the following more detailed description of the invention, particularly, when such description is taken in conjunction with the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. 1 is a block diagram of a system to provide enhanced security and control of locomotives and trains.

BRIEF DESCRIPTION OF A PRESENTLY PREFERRED AND VARIOUS ALTERNATIVE EMBODIMENTS OF THE INVENTION

[0025] A method of at least one of automatically shutting down and stopping a train consist is provided by the instant invention. According to a presently preferred embodiment of the invention, when an emergency condition exists, the method includes the step of connecting a railway telemetry means for communication with a first control computer 14 disposed on a locomotive 12. It should be understood that a train consist may have more than one locomotive. Each of these locomotives 12 may or may not be equipped with a first such control computer 14. However, at least one of the locomotives 12 must be so equipped for implementation of the present invention.

[0026] The method further includes the additional steps of connecting at least one predetermined emergency sensing means 34 for communication with such railway telemetry means and determining when at least one emergency condition exists. When it is determined that an emergency condition exists an at least one of an emergency condition signal and an emergency brake signal is generated via such at least one predetermined emergency sensing means 34.

[0027] The at least one of such emergency condition signal and the emergency brake signal generated is then communicated to such first control computer 14 via the railway telemetry means. The first control computer 14 is then utilized to generate at least one of an engine shut down command signal and an emergency brake command signal

in response to the at least one of such emergency condition signal and such emergency brake signal communicated to it as described above.

[0028] The at least one of such engine shut down command signal and the emergency brake command signal generated in the first control computer **14** is communicated to an engine control system **16** and a brake control system **18**, respectively, and at least one of automatically shutting down and stopping such train consist in response to the at least one of such engine shut down command signal and such emergency brake command signal occurs.

[0029] That an emergency condition exists can be determined in a number of ways. For example only, the emergency condition can be determined by electronic sensors or by visually sighting a condition that would and/or could present an emergency. Nevertheless, the signal representative of such emergency condition will be communicated electronically.

[0030] In the presently preferred embodiment of the invention the engine shut down command signal is communicated to such engine control system **16** through a Locomotive Security Module (LSM) **22** which communicates the signal via a radio frequency (RF) interface **32** and such emergency brake command signal is communicated to the brake control system **18** through a Security Control Device (SCD) **24**.

[0031] Additionally, the invention encompasses the additional step of remotely identifying that an emergency condition exists and generating a remote signal which is representative of such emergency condition.

[0032] It is within the scope of the present invention for the method of remotely identifying an emergency condition exists and generating a signal representative of said emergency condition to be redundant. Further the method may include the additional step of generating at least one of a remote engine shut down command signal and a remote emergency brake command signal for such at least one of shutting down and stopping the train consist.

[0033] According to the presently preferred embodiment of the invention the method of generating the at least one of a remote engine shut down command signal and a remote emergency brake command signal includes the additional steps of establishing a communication link between a first transceiver **26** disposed on a locomotive **12** and at least one second remote transceiver **36** and connecting a locomotive interface unit (LIU) **28** which communicates via an RF interface **32** to at least one second remote control computer **36** for communication with at least one of the engine control system **16** and such brake control system **18** via such communication link provided. Connecting at least one predetermined emergency sensing means **34** for communication with such second remote computer **36** and remotely determining when at least one emergency condition exists in response to at least one predetermined emergency sensing means **34** as communicated via such second remote control computer **36** and generating at least one of an engine shut down command signal and an emergency brake command signal. Then communicating the at least one of such engine shut down command signal and such emergency brake command signal generated to the engine control system **16** and the brake control system **18**, respectively, via the LIU

28. Then at least one of shut down and stop such train consist in response to the at least one engine shut down command signal and such emergency brake command signal, respectively.

[0034] Finally, according to the present invention, the generation of the at least one remote engine shut down command signal and the at least one remote emergency brake command signal is redundant.

[0035] While both a presently preferred and a number of alternative embodiments of the invention have been described above it should be noted that various other adaptations and modifications can be envisioned by those persons skilled in the art without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. A method of at least one of automatically shutting down and stopping a train consist when an emergency condition exists, said method comprising the steps of:

- a) connecting a railway telemetry means for communication with a first control computer disposed on a locomotive;
- b) connecting at least one predetermined emergency sensing means for communication with said railway telemetry means;
- c) determining when at least one said emergency condition exists and generating at least one of an emergency condition signal and an emergency brake signal via said at least one predetermined emergency sensing means;
- d) communicating at least one of said emergency condition signal and said emergency brake signal generated in step (c) to said first control computer via said railway telemetry means;
- e) utilizing said first control computer to generate at least one of an engine shut down command signal and an emergency brake command signal in response to at least one of said emergency condition signal and said emergency brake signal communicated in step (d);
- f) communicating at least one of said engine shut down command signal and said emergency brake command signal to an engine control system and a brake control system respectively; and
- g) at least one of automatically shutting down and stopping such train consist in response to at least one of said engine shut down command signal and said emergency brake command signal.

2. A method, according to claim 1, wherein said emergency condition signal is electronic.

3. A method, according to claim 1, wherein said emergency condition signal is visual.

4. A method, according to claim 1, wherein said first control computer is at least one.

5. A method, according to claim 1, wherein said engine shut down command signal is communicated to said engine control system through a Locomotive Security Module (LSM).

6. A method, according to claim 1, wherein said emergency brake command signal is communicated to said brake control system through a Security Control Device (SCD).

7. A method, according to claim 1, wherein said method includes the additional step of remotely identifying an emergency condition exists and generating a remote signal representative of said emergency condition.

8. A method, according to claim 5, wherein said LSM communicates via a radio frequency (RF) interface.

9. A method, according to claim 7, wherein said method of remotely identifying an emergency condition exists and generating a signal representative of said emergency condition is redundant.

10. A method, according to claim 7, wherein said method includes the additional step of generating at least one of a remote engine shut down command signal and a remote emergency brake command signal for said at least one of shutting down and stopping said train consist.

11. A method, according to claim 10, wherein said method of generating said at least one of a remote engine shut down command signal and a remote emergency brake command signal includes the additional steps of:

- a) establishing a communication link between a first transceiver disposed on a locomotive and a second remote transceiver;
- b) connecting a locomotive interface unit (LIU) to a second remote control computer for communication with at least one of a said engine control system and said brake control system via said communication link provided in step (a);
- c) connecting at least one predetermined emergency sensing means for communication with said second remote computer;

d) remotely determining when at least one said emergency condition exists in response to at least one said predetermined emergency sensing means as communicated in step (c) via said second remote control computer and generating at least one of an engine shut down command signal and an emergency brake command signal;

e) communicating said at least one of said engine shut down command signal and said emergency brake command signal generated in step (d) to said engine control system and said brake control system respectively via said LIU; and

f) at least one of shutting down and stopping said train consist in response to said at least one said engine shut down command signal and said emergency brake command signal respectively.

12. A method, according to claim 11, wherein said method of generating at least one said remote engine shut down command signal is redundant.

13. A method, according to claim 11, wherein said method of generating at least one said remote emergency brake command signal is redundant.

14. A method, according to claim 11, wherein said remote transceiver is at least one.

15. A method, according to claim 11, where in said remote control computer is at least one.

16. A method, according to claim 11, where in said LIU communicates via an RF interface.

* * * * *