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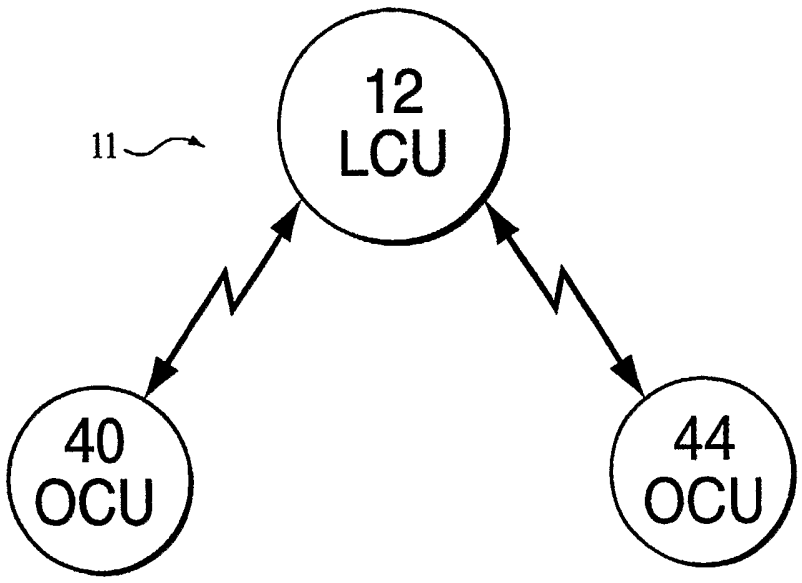
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEM AND METHOD FOR WIRELESS REMOTE CONTROL OF LOCOMOTIVES



(57) Abstract: A system and method for remotely controlling an increased number of subsystems having an onboard locomotive control unit (LCU) and two associated operator control units (OCUs) on a single wireless channel. A time slot is assigned to each subsystem for making two-way transmissions to control the locomotive. A signal from an external timing source synchronizes each subsystem to minimize interference between transmissions from different subsystems. Time slots are assigned manually or automatically over a wireless network or by the LCU after monitoring the channel. The LCU automatically selects the direct or repeater transmission path depending upon whether or not it receives polling message responses from its associated OCUs. A GPS receiver in each subsystem receives the synchronization signal and provides geographic positioning data so the LCU can determine when to execute predefined, position-based commands. The secondary OCU may be turned off and rejoined to the subsystem without ceasing operation.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/24029

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **H04J 3/06**(2006.01)

USPC: 370/316,324,350,503,520,522

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)

U.S. : 370/316,324,350,503,520,522

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)

POLL$4 AND SYNCHRONIZ$6 AND CONTROL$4 AND (TIME ADJ$1 SLOT) AND @AD<=20020731

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,088,590 A (ANDERSON et al) 11 July 2000 (11.07.2000), column 1, line 48 - column 2, line 49.	1-77,88-93,126-131,200-206
Y	US 5,648,955 A (JENSEN et al) 15 July 1997 (15.07.1997) column 1, line 49-column 2, line 49.	1-77,88-93,126-131,200-206
Y	US 5,537,414 A (TAKIYASU et al) 16 July 1996 (16.07.1996) column 6, line 30-column 11, line 67.	1-77,88-93,126-131,200-206
Y	US 5,732,076 A (KETSEOGLOU et al) 24 March 1998 (24.03.1998) column 3, lines 7-32	1-77,88-93,126-131,200-206
Y	US 6,370,381 A (MINNICK et al) 09 April 2002 (09.04.2002) column 2, line 1-column 3, line 8	1-77,88-93,126-131,200-206
Y	US 6,243,372 A (PETCH et al) 05 June 2001 (05.06.2001) column 2, line 49-column 4, line 39.	1-77,88-93,126-131,200-206
Y	US 5,737,330 A (FULTHORP et al) 07 April 1998 (07.04.1998) column 2, line 24-column 4, line 29.	1-77,88-93,126-131,200-206

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

* Special categories of cited documents:

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

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"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

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,696,903 A (MAHANY) 09 December 1997 (09.12.1997) column 4, line 55-column 8, line 20.	1-77,88-93,126-131,200-206
Y	US 5,689,502 A (SCOTT) 18 November 1997 (18.11.1997), column 4, line 32-column 5, line 35	1-77,88-93,126-131,200-206
Y	US 5,526,357 A (JANDRELL) 11 June 1996 (11.06.1996), column 3, line 56-column 6, line 33.	1-77,88-93,126-131,200-206

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/24029

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: Please See Continuation Sheet

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

Group 1-Claims 1-77, 88-93, 126-131, 200-206, is directed to the controller assigning time slot to transmit polling messages, classified to 370/449 (H 04 L 12/42) for channel assignment techniques in which individual terminals are queried to determine if access to the transmission medium is needed for the transfer of information.

Group 2-Claims 81-87, 134-149, 171-197, is directed to a repeater receiving and transmitting signals from/to controller and control units on the second half duplex wireless channel, classified to 370/315 (H 04 7/14) for communication over free space in which multiplex communication signals are transmitted over a medium which is not a wire or a waveguide, and having at least a station which retransmits signals of other stations to compensate for attenuation lossess or to extend the communcation range between a group of stations.

Group 3-Claims 94-119, is directed to a geographic position determining means for periodically providing coordinates of the geographic position of a locomotive to a controller, classified to 455/404.2 (H 04 M 11/04) for location monitoring by determining the position of a radiotelephone which has made an emergency or alarm call.

Group 4-Claims 120-125, 153-170, 198-199, is directed to switching by selecting settings for speed, direction of travel, brake, classified to 370/360 (H 04 L 12/50) for properly switching of information from an input of the switching network to an output of the network.

Continuation of Box II Item 4:

Group 1-Claims 1-77, 88-93, 126-131, 200-206, is directed to the controller assigning time slot to transmit polling messages, classified to 370/449 (H 04 L 12/42) for channel assignment techniques in which individual terminals are queried to determine if access to the transmission medium is needed for the transfer of information.

Group 2-Claims 81-87, 134-149, 171-197, is directed to a repeater receiving and transmitting signals from/to controller and control units on the second half duplex wireless channel, classified to 370/315 (H 04 7/14) for communication over free space in which multiplex communication signals are transmitted over a medium which is not a wire or a waveguide, and having at least a station which retransmits signals of other stations to compensate for attenuation lossess or to extend the communcation range between a group of stations.

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Group 4-Claims 120-125, 153-170, 198-199, is directed to switching by selecting settings for speed, direction of travel, brake, classified to 370/360 (H 04 L 12/50) for properly switching of information from an input of the switching network to an output of the network.