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G06Q 50/08 (2012.01)

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(88) Date of publication of the international search report: 18 February 2016

(54) Title: METHOD, SYSTEM AND RELATED DEVICES FOR OPERATING MULTIPLE CRANES IN UNISON

(57) Abstract: A crane control system for controlling a plurality of cranes is provided. The crane control system in some embodiments includes a master controller unit, at least one computer readable memory for storing a plurality of tokens, each token from the plurality of tokens associated with a respective crane from the plurality of cranes, and a processing unit responsive to commands inputted by an operator of the master controller unit to send the commands to individual cranes from the plurality of cranes wherein the processing unit associates the commands with respective tokens to control the cranes associated with those tokens. The crane control system in some embodiments also includes a processing unit that is responsive to a signal indicative of a synchronization loss to issue a command to bring the plurality of cranes into a safe condition, such as an emergency stop, or a corrective action.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B66C 23/86; G06Q 50/08; G08G 1/0968 (2015.01)
CPC - B66C 13/38, 23/585; G08G1/20
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) Classification(s): B66C 23/86; G06Q 50/08; G08G 1/0968, 1/16 (2015.01)
CPC Classification(s): B66C 13/38, 13/40, 23/585; G08G 1/20

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)
PatSear (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google Scholar; IEEE; EBSCO
Keywords used: crane; control; master; slave; token; wireless communication; synchronization; emergency stop; monitoring; sense

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 8,195,368 B1 (LEBAN, F et al.) June 5, 2012; abstract; figure 12; column 3, lines 56-65; column 12, lines 21-33; claim 11</td>
<td>1, 8-9, 11,13, 21-25</td>
</tr>
<tr>
<td>Y</td>
<td>WO 2013/170036 A1 (MANITOWOC CRANE COMPANIES) November 14, 2013; figure 1; paragraphs [0035]; [0038-0041]</td>
<td>6-7</td>
</tr>
<tr>
<td>Y</td>
<td>WO 2013/030929 A1 (DEMAG CRANES &amp; COMPONENTS GMBH) March 7, 2013; see machine translation; page 21, lines 17-20; page 25, lines 31-33; page 26, lines 1-17</td>
<td>10, 26</td>
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<td>Y</td>
<td>WO 2002/014202 A1 (PSA CORPORATION LIMITED) February 21, 2002; abstract; page 2, lines 30-35; page 3, lines 1-7</td>
<td>12</td>
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<tr>
<td>A</td>
<td>CN 202322054 U (CHONGQING CRANE WORKS CO LTD) July 11, 2012; entire document</td>
<td>1-13, 21-26</td>
</tr>
</tbody>
</table>

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

Date of the actual completion of the international search 16 September 2015 (16.09.2015)
Date of mailing of the international search report 04 DEC 2015

Name and mailing address of the ISA/Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)
INTERNATIONAL SEARCH REPORT

<table>
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<th>Box No. II</th>
<th>Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)</th>
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<td></td>
<td>This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:</td>
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<tr>
<td>1. □ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:</td>
<td></td>
</tr>
<tr>
<td>2. □ Claims 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:</td>
<td></td>
</tr>
<tr>
<td>3. □ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).</td>
<td></td>
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<table>
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<th>Box No. III</th>
<th>Observations where unity of invention is lacking (Continuation of item 3 of first sheet)</th>
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<tr>
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<td>This International Searching Authority found multiple inventions in this international application, as follows:</td>
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<td>see extra sheet</td>
</tr>
<tr>
<td>1. □</td>
<td>As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</td>
</tr>
<tr>
<td>2. □</td>
<td>As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.</td>
</tr>
<tr>
<td>3. □</td>
<td>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.:</td>
</tr>
<tr>
<td>4. ×</td>
<td>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.: 1-13, 21-26</td>
</tr>
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</table>

Remark on Protest □ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.
□ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.
□ No protest accompanied the payment of additional search fees.
The application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-13, 21-26 are directed toward a master controller unit, a computer readable storage for storing a plurality of tokens, a plurality of cranes, a processing unit, and commands.

Group II: Claims 14-20 are directed toward a master controller unit, a user interface, commands, a mode selector, a plurality of modes of operation, and a plurality of cranes.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features.

Group I has at least a computer readable storage for storing a plurality of tokens and a processing unit that Group II does not have.

Group II has at least a user interface, a mode selector and a plurality of modes of operation that Group I does not have.

The common technical features of Groups I-II are a master controller unit, a plurality of cranes, and commands. The common technical features are disclosed by CN 202322054 U Chongqing Crane Works Co. LTD (hereinafter "Chongqing"). Chongqing discloses a master controller unit (main control device; paragraph [0008-0009]), a plurality of cranes (first crane and second crane; paragraph [0008-0009]), and commands (sending order (command) to each crane; paragraph [0004-0008]).

Since the common technical features are previously disclosed by the Chongqing reference, these common features are not special and so Groups I-II lack unity.