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(54) Title: TOOL MONITORING SYSTEM

(57) **Abstract:** The present invention relates to a system for monitoring a set of tools, to enable a user to determine whether each tool in the set has been replaced in its container after use, comprising a transponder attached to each tool in the set; a unique tool name assigned to each transponder; an inventory of the tool names of the set of tools, associated with the tool container; a proximity sensor provided on the tool container, which is capable of communicating with each transponder to identify which tools in the set are in the tool container and which tools in the set are not in the tool container; means for comparing the tools which are identified as being in the tool container with the inventory; and means for providing an indication to the user if all of the tools in the set are not in the tool container.



WO 2005/109266 A1

TOOL MONITORING SYSTEM

Field of the Invention

The invention relates to a system for monitoring use and position of tools, in particular mechanical and diagnostic tools. The invention also relates to a system for tracking medical instruments.

Background to the Invention

In mechanical workshops and other industrial situations it is necessary to keep track of the position of various tools and instruments. For example, a mechanic must ensure that he does not leave tools inside a customer's car. In the case of work being done on jet engines, leaving a tool inside the engine could have dangerous consequences. The mechanic is therefore required to check that all tools are accounted for when a particular job is completed.

In order to facilitate this check, it is well known to provide a toolbox with a number of foam cutouts. Each tool has a designated position in the toolbox marked by a piece of foam with a cutout section dimensioned to accommodate that particular tool. When a tool is replaced in the toolbox after use it is placed into its designated foam cutout. The mechanic can then see, at a glance, whether all of the tools have been replaced. A missing tool is easily identified by means of the empty cutout.

However, there are a number of disadvantages to this system. The first is that each time a new tool is acquired, a new cutout, dimensioned to exactly accommodate the new tool, must be made. The second disadvantage is that the cutouts in the toolbox take up a large amount of space, since by their nature they must be larger than the tools they accommodate. This means that the toolbox must be significantly larger than is strictly necessary to contain the tools.

A similar problem is encountered during surgical operations. In order to preserve patient safety, it is extremely important that a medical instrument is not left inside the patient after surgery. The present system for preventing retained foreign bodies is for nursing staff to count instruments routinely before surgery and before

closure. However, this procedure is time-consuming and error-prone and incidents of retained instruments still occur.

A further problem in the mechanical field is the use of diagnostic tools. It is normal practice to charge a customer a higher fee for use of particular items of diagnostic equipment. The charge is calculated by determining the how long the diagnostic tool has been used on a particular vehicle. This system relies on each mechanic keeping an accurate record of when he starts using the tool and when he has finished using the tool. The system is thus prone to human error.

Object of the Invention

An object of the present invention is to provide a system for monitoring tools to enable a user to determine whether all tools have been replaced in their container, which overcomes the problems with the prior art outlined above. It is a further object of the invention to provide a similar system for monitoring medical instruments. It is yet another object of the invention to provide a system for automatically billing the customer for diagnostic tool use.

Summary of the Invention

A system for monitoring a set of tools, to enable a user to determine whether each tool in the set has been replaced in its container after use, comprising:

- a transponder attached to each tool in the set;
- a unique tool name assigned to each transponder;
- an inventory of the tool names of the set of tools, associated with the tool container;

a proximity sensor provided on the tool container, which is capable of communicating with each transponder to identify which tools in the set are in the tool container and which tools in the set are not in the tool container;

means for comparing the tools which are identified as being in the tool container with the inventory; and

means for providing an indication to the user if all of the tools in the set are not in the tool container.

It is to be appreciated that the set of tools may comprise only one tool, or a plurality of tools. Furthermore the tool container may be provided as a toolbox or, for example, a tray for medical instruments.

An advantage of the present invention is the provision of a system that gives an immediate indication as to whether a complete set of tools has been replaced in the tool container. A further advantage of the invention is that the system is not prone to human error. Yet another advantage of the system is that the system does not occupy a large amount of space in the toolbox or tool container.

According to a preferred feature of the invention, the transponder is a passive transponder. The transponder may be provided with an adhesive backing for attachment to the tool. Transponders of this type are widely and cheaply available in sheets with an adhesive backing. A transponder may simply be peeled from such a sheet and attached to a new tool. The user need only then assign a unique tool name to the new tool and add the new tool name to the inventory. This provides the advantage that new tools may be quickly and simply added to the tool set. A supply of transponders can be kept and applied to new tools as they are acquired.

Optionally, the system further comprises means for assigning a unique tool name to a transponder. The system may further comprise means for creating an inventory of the tool names of the set of tools. The system may further comprise means for associating the inventory with the tool container.

Any of the means for assigning a unique tool name, the means for creating an inventory of the tool names, the means for associating the inventory with the tool container and the means for comparing the tools in the container with the inventory may be provided by a computer program running on a computer, which is connectable to the tool container.

The indication provided to the user may be a visual or audio indication, for example by means of an LED or an audible alarm.

According to one embodiment of the present invention, the set of tools comprises a set of medical instruments. In this embodiment, the tool container may be a tray for medical instruments. An advantage of this embodiment of the invention is that accidental retention of instruments in patients can be prevented without engaging nursing staff in time-consuming instrument counts.

The system may further comprise means for calculating the period of time a tool in the set is not in the container; means for determining a monetary amount to charge a customer for use of the tool; and means for automatically adding the monetary amount to a bill to be charged to the customer. This allows the user to charge a customer for use of a particular diagnostic tool without requiring him to keep an accurate written record of the period of use of the tool.

Preferably, the means for calculating the period of time a tool is not in the tool container, the means for determining the monetary amount and the means for adding the monetary amount to the customer's bill are also provided by a computer program running on a computer, which is connectable to the tool container.

According to one embodiment of the present invention a plurality of users may access the set of tools and the tool container, and the system further comprises a user proximity sensor associated with each user, which is capable of communicating with each tool transponder to determine if any tool in the set is proximal to that user and means provided on the tool container for indicating if a tool is proximal to a user. Each user proximity sensor may be provided on a key fob. An advantage of this feature is that it allows tools to be shared more effectively in a workshop by providing an indication to each user of where each tool in the set is.

According to an optional feature of the invention, the system further comprises an exit proximity sensor provided on an exit from a location at which the set of tools is kept, which is capable of communicating with each transponder to determine if any tool in the set is proximal to the exit and means for providing an indication that at least one of the tools in the set is proximal to the exit. The indication that at least one of the tools

in the set is proximal to the exit may be a visual or audio indication. This feature of the invention may be used to prevent theft of tools, by giving an indication a tool is being removed from the location.

The words “comprises/comprising” and the words “having/including” when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Claims

1. A system for monitoring a set of tools, to enable a user to determine whether each tool in the set has been replaced in its container after use, comprising:
 - a transponder attached to each tool in the set;
 - a unique tool name assigned to each transponder;
 - an inventory of the tool names of the set of tools, associated with the tool container;
 - a proximity sensor provided on the tool container, which is capable of communicating with each transponder to identify which tools in the set are in the tool container and which tools in the set are not in the tool container;
 - means for comparing the tools which are identified as being in the tool container with the inventory; and
 - means for providing an indication to the user if all of the tools in the set are not in the tool container.
2. A system for monitoring a set of tools as claimed in claim 1, wherein the transponder is a passive transponder.
3. A system for monitoring a set of tools as claimed in any preceding claim, wherein the transponder is provided with an adhesive backing for attachment to the tool.
4. A system for monitoring a set of tools as claimed in any preceding claim, further comprising means for assigning a unique tool name to a transponder.
5. A system for monitoring a set of tools as claimed in any preceding claim, further comprising means for creating an inventory of the tool names of the set of tools.
6. A system for monitoring a set of tools as claimed in any preceding claim, further comprising means for associating the inventory with the tool container.

7. A system for monitoring a set of tools as claimed in claim 4, 5 or 6, wherein the means for assigning a unique tool name to a transponder is provided by a computer program running on a computer, which is connectable to the tool container.
8. A system for monitoring a set of tools as claimed in claim 5, 6 or 7, wherein the means for creating an inventory of the tool names of the set of tools is provided by a computer program running on a computer, which is connectable to the tool container.
9. A system for monitoring a set of tools as claimed in claim 6, 7 or 8, wherein the means for associating the inventory with the tool container is provided by a computer program running on a computer, which is connectable to the tool container.
10. A system for monitoring a set of tools as claimed in any preceding claim, wherein the means for comparing the tools which are identified as being in the container with the inventory is provided by a computer program running on a computer, which is connectable to the tool container.
11. A system for monitoring a set of tools as claimed in any preceding claim, wherein the indication provided to the user is a visual or audio indication.
12. A system for monitoring a set of tools as claimed in any preceding claim, wherein the set of tools comprises a set of medical instruments.
13. A system for monitoring a set of tools as claimed in any preceding claim, further comprising:
 - means for calculating the period of time a tool in the set is not in the container;
 - means for determining a monetary amount to charge a customer for use of the tool;
 - means for automatically adding the monetary amount to a bill to be charged to the customer.
14. A system for monitoring a set of tools as claimed in claim 13, wherein the means for calculating the period of time a tool is not in the tool container, the means for

determining the monetary amount and the means for adding the monetary amount to the customer's bill are provided by a computer program running on a computer, which is connectable to the tool container.

15. A system according to any preceding claim, wherein a plurality of users may access the set of tools and the tool container, and further comprising:

a user proximity sensor associated with each user, which is capable of communicating with each tool transponder to determine if any tool in the set is proximal to that user;

means provided on the tool container for indicating if a tool is proximal to a user.

16. A system for monitoring a set of tools according to claim 15, wherein each user proximity sensor is provided on a key fob.

17. A system for monitoring a set of tools as claimed in any preceding claim, further comprising:

an exit proximity sensor provided on an exit from a location at which the set of tools is kept, which is capable of communicating with each transponder to determine if any tool in the set is proximal to the exit; and

means for providing an indication that at least one of the tools in the set is proximal to the exit.

18. A system for monitoring a set of tools as claimed in claim 17, wherein the indication that at least one of the tools in the set is proximal to the exit is a visual or audio indication.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F17/60 G07G3/00 G07G1/00 G06K17/00 A61B5/06

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)

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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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 329 743 A (TECHTALION LIMITED) 23 July 2003 (2003-07-23) abstract paragraph '0004! paragraph '0006! paragraph '0012! - paragraph '0014! paragraph '0017! paragraph '0019! -----	1-18
X	US 5 920 261 A (HUGHES ET AL) 6 July 1999 (1999-07-06) column 6, line 13 - line 22 -----	1-18
A	US 4 114 601 A (ABELS ET AL) 19 September 1978 (1978-09-19) abstract column 4, line 20 - line 22 column 6, line 20 - line 37 ----- -/--	1-18



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No

● T/IE2004/000066

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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