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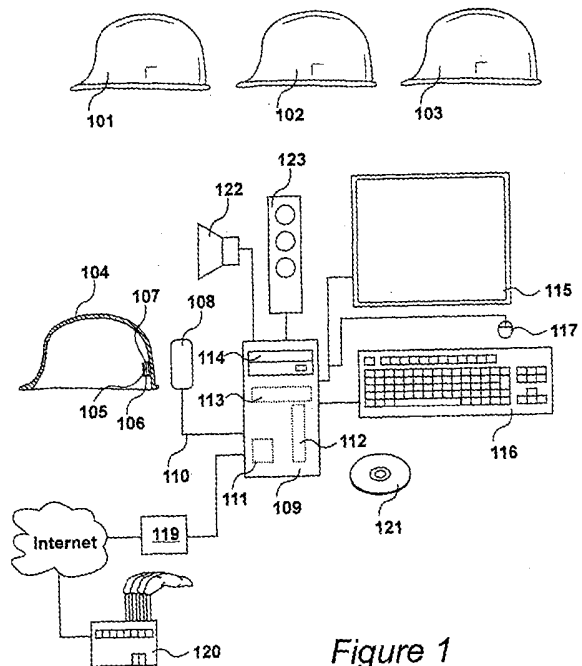
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(54) Abstract Title: Recording and monitoring the inspection of safety items

(57) A unique identifier is provided (by way of RFID device or a transducer device 105) for each of a number of items of safety equipment (eg safety helmets 101-104 as worn by construction workers). The unique identifiers are also stored in a database. The items are inspected and unique identifiers are read from each of the inspected items using e.g. RFID reader 108. For each inspected item, the date of inspection is stored in the database. A period from the date of the inspection to the present time is monitored. Items for which the period exceeds a predetermined period are subsequently identified and an output may be provided indicating that further inspection is required. The database may also include "end of life", and manufacturing date information which it may obtain via the internet. The system may include a computer 109, which is attached to loudspeaker 122 and LED array 123, which can be used to provide audio and visual alarm signals. The system may also be used to perform on the spot checks of workers to see that they are using monitored safety equipment.



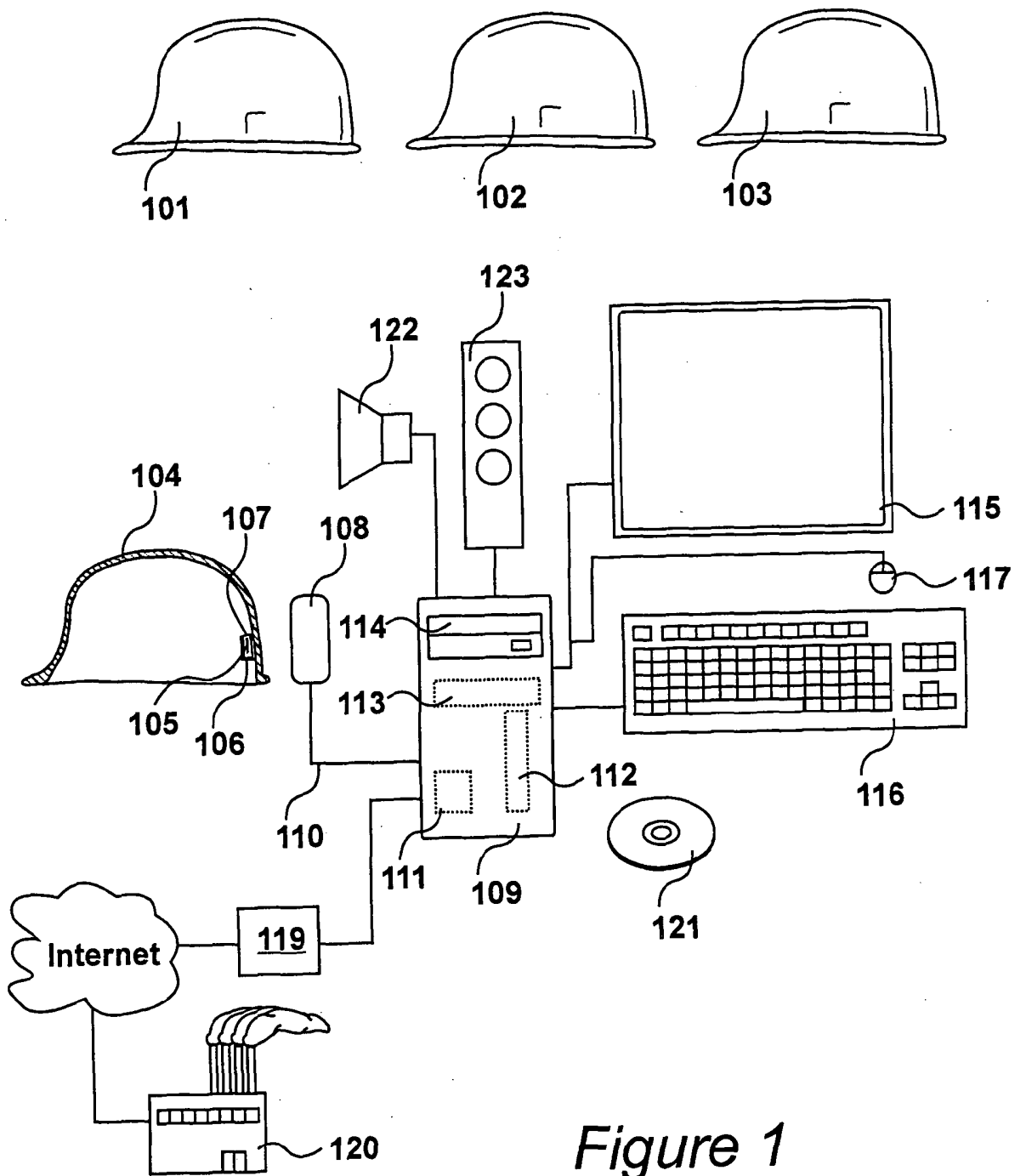


Figure 1

Helmet ID	02000159	00008714	00001926	02817992	← 201
Date of manufacture	28-05-07	13-10-07	03-03-02	16-12-07	← 202
End of life	28-05-12	13-10-09	03-03-07	24-10-13	← 204
Manufacturer	HRU	SAN	OHM	HRU	← 203
Owner	B.I.G PLC	B.I.G PLC	JOHNS LTD	B.I.G PLC	← 205
User Surname	CASE	SOUTH	NONE	KING	← 206
User first name	EDWARD	DANIEL	NONE	JOANNE	← 207
Issue date	17-07-07	24-02-05	07-06-02	24-01-08	← 208
Date of last inspection	21-04-08	25-02-08	19-05-06	21-04-08	← 209
Inspector	F. SHARP	T. STAINS	E. BROWN	F. SHARP	← 210
Next inspection due	21-07-08	25-05-08	19-08-06	21-07-08	← 211
Emergency contact	MARY CASE	JANE TRENT	NONE	DAVID EVE	← 212
Emergency phone number	0298332156	0298426359	—	0298445798	← 213

Figure 2

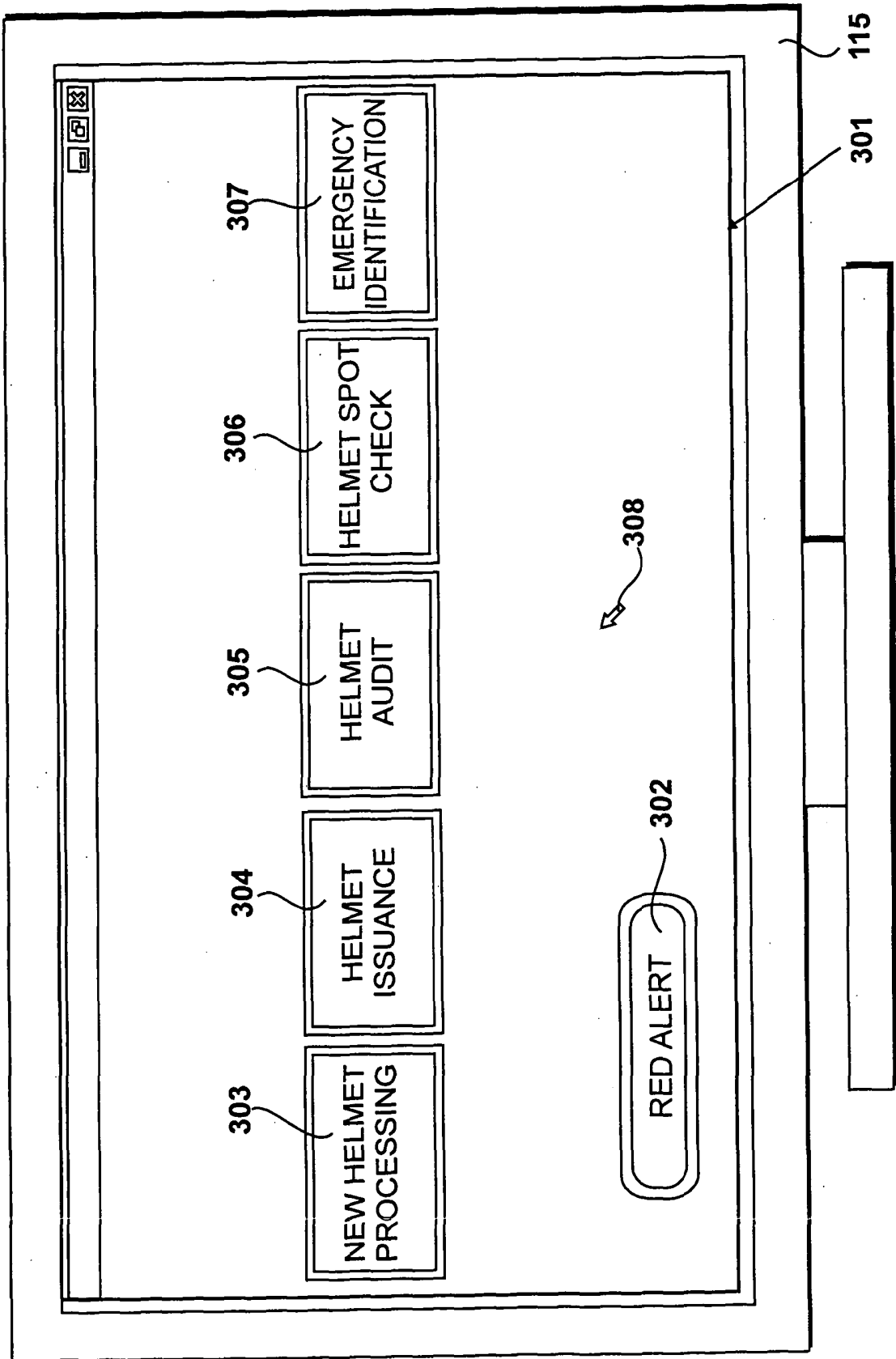


Figure 3

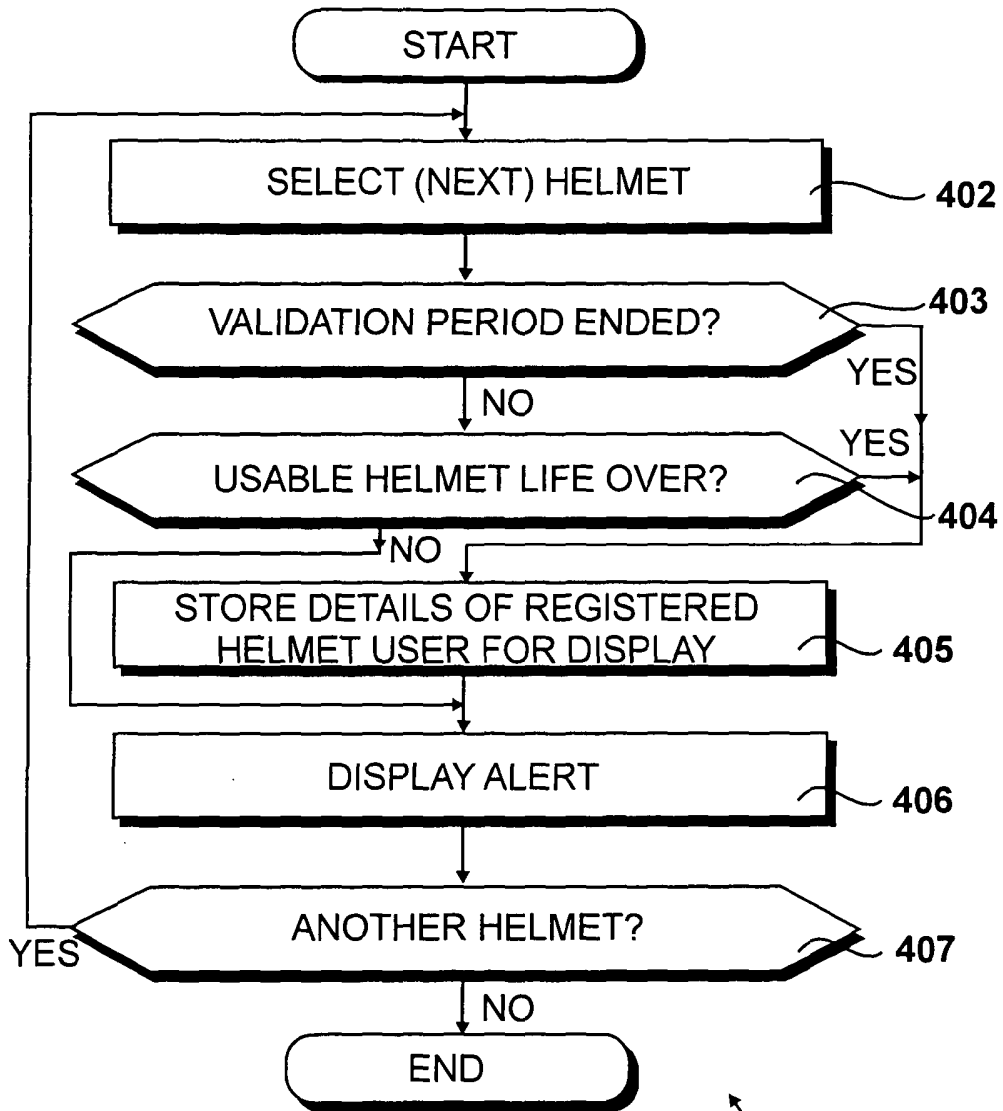


Figure 4

401

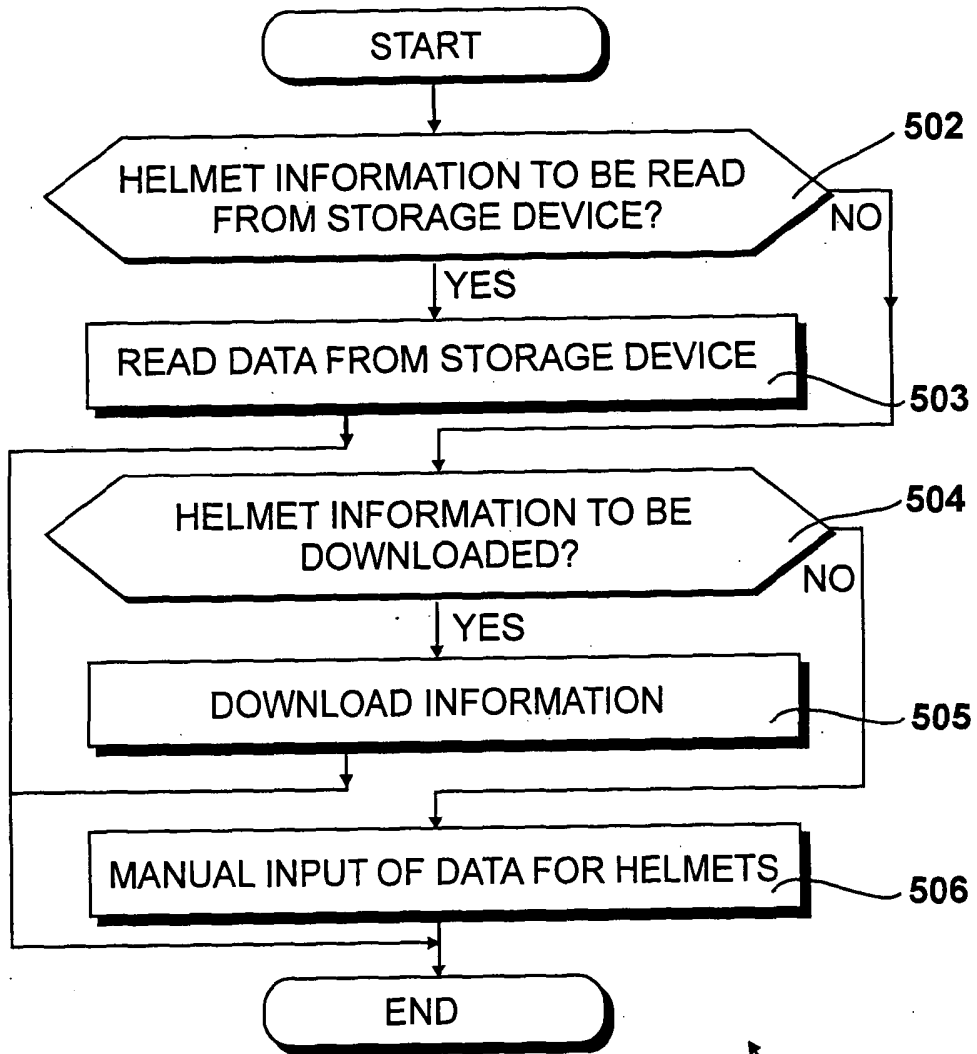


Figure 5

501

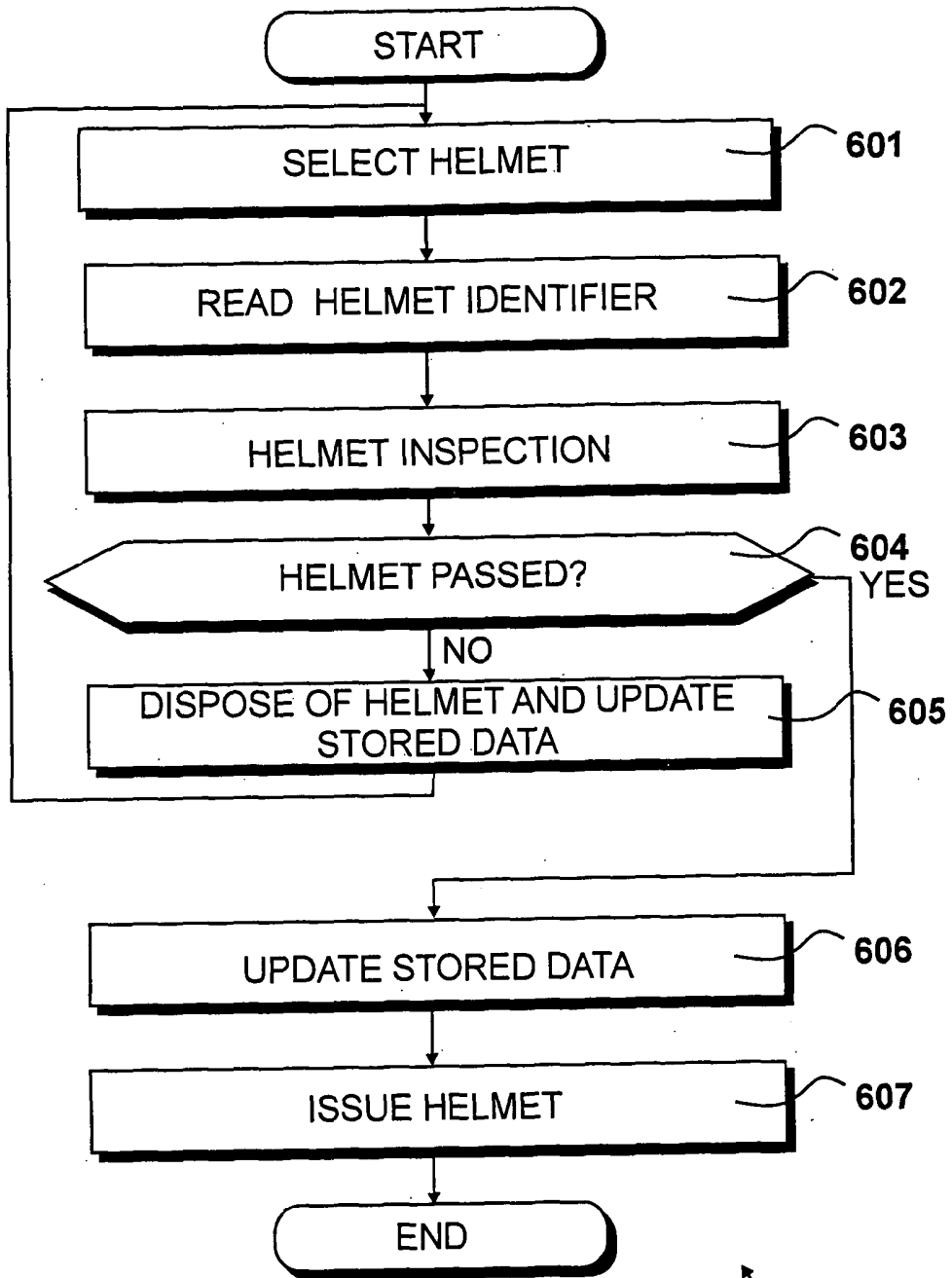


Figure 6

600

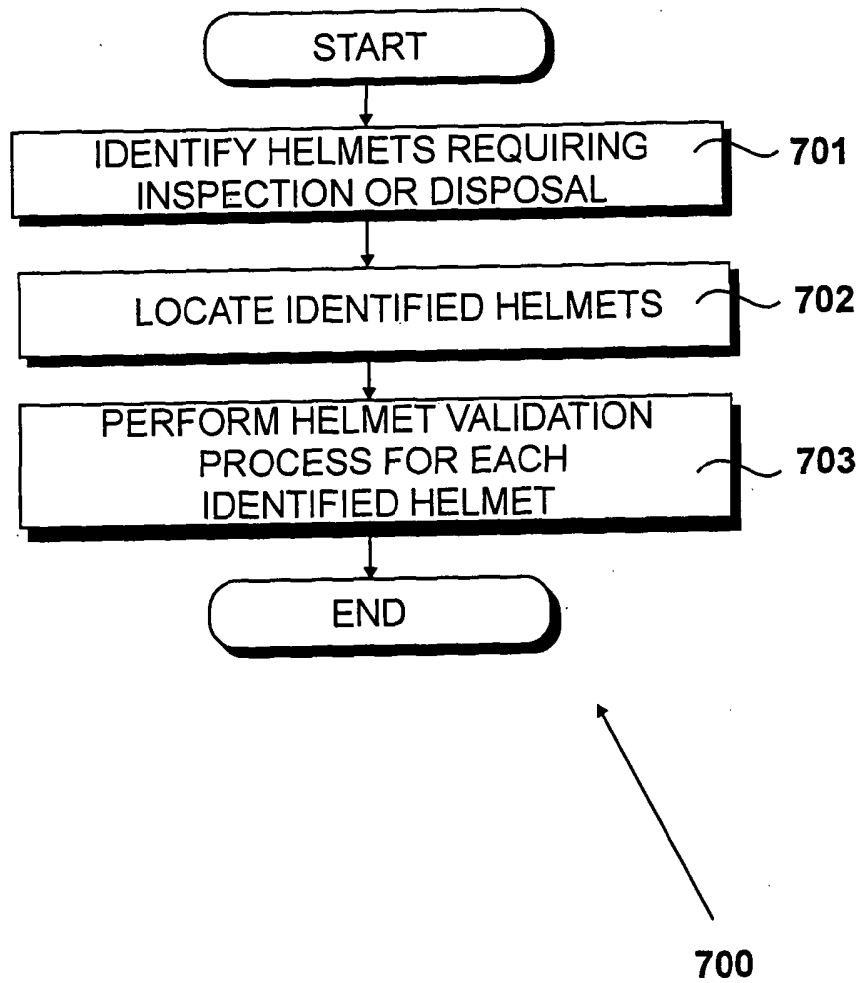


Figure 7

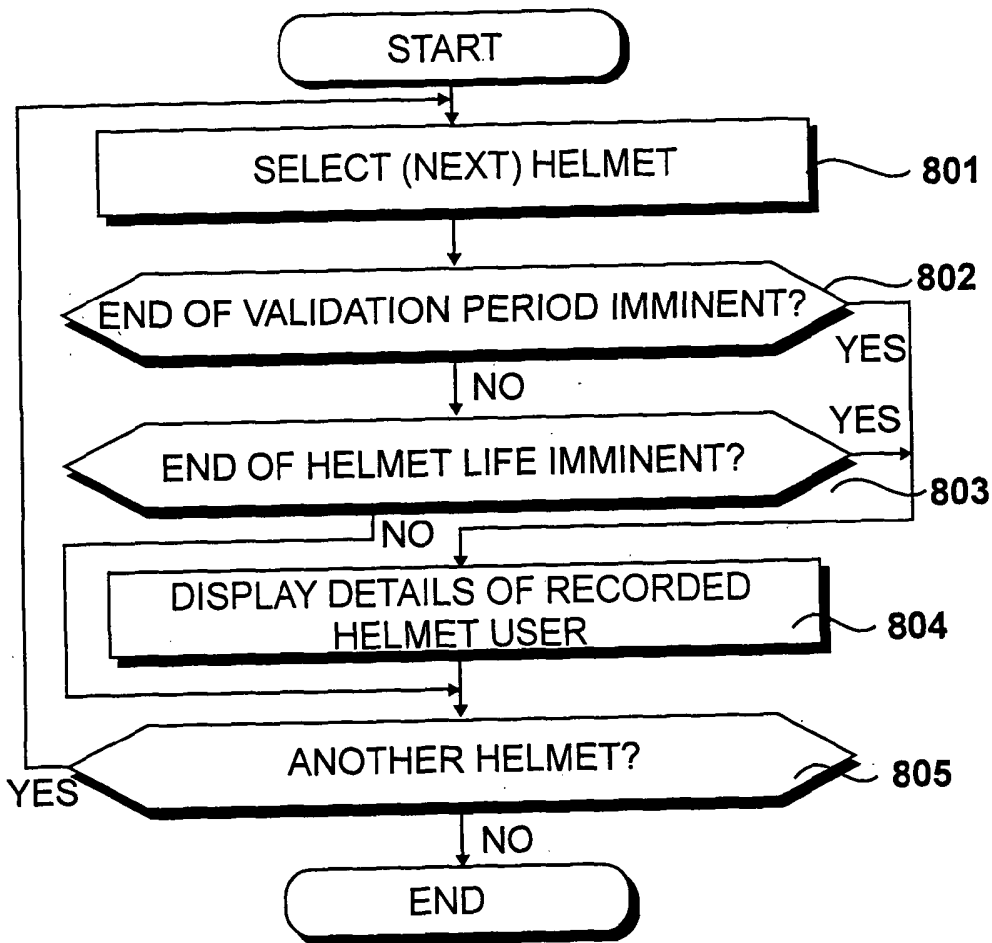


Figure 8

9/10

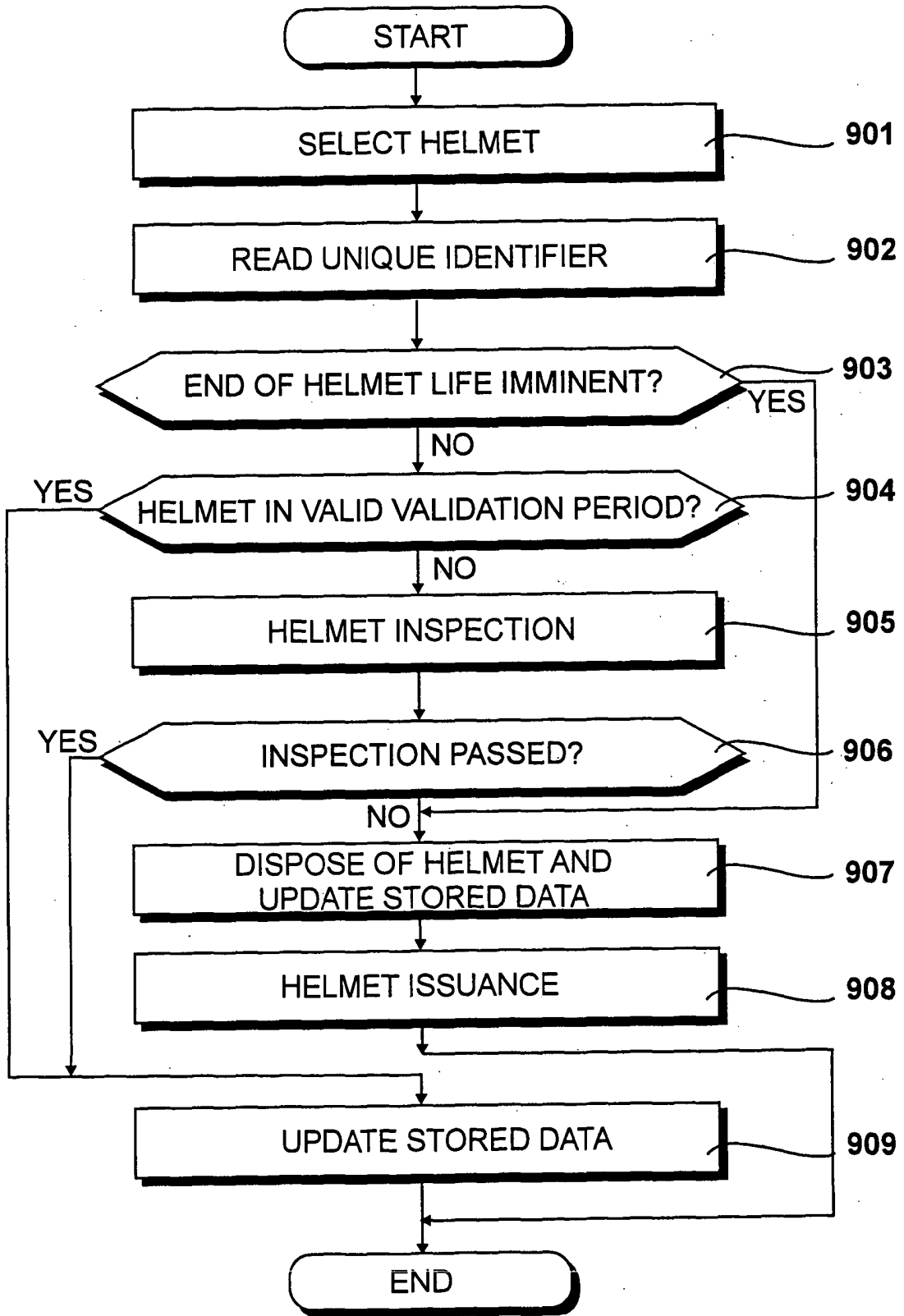


Figure 9

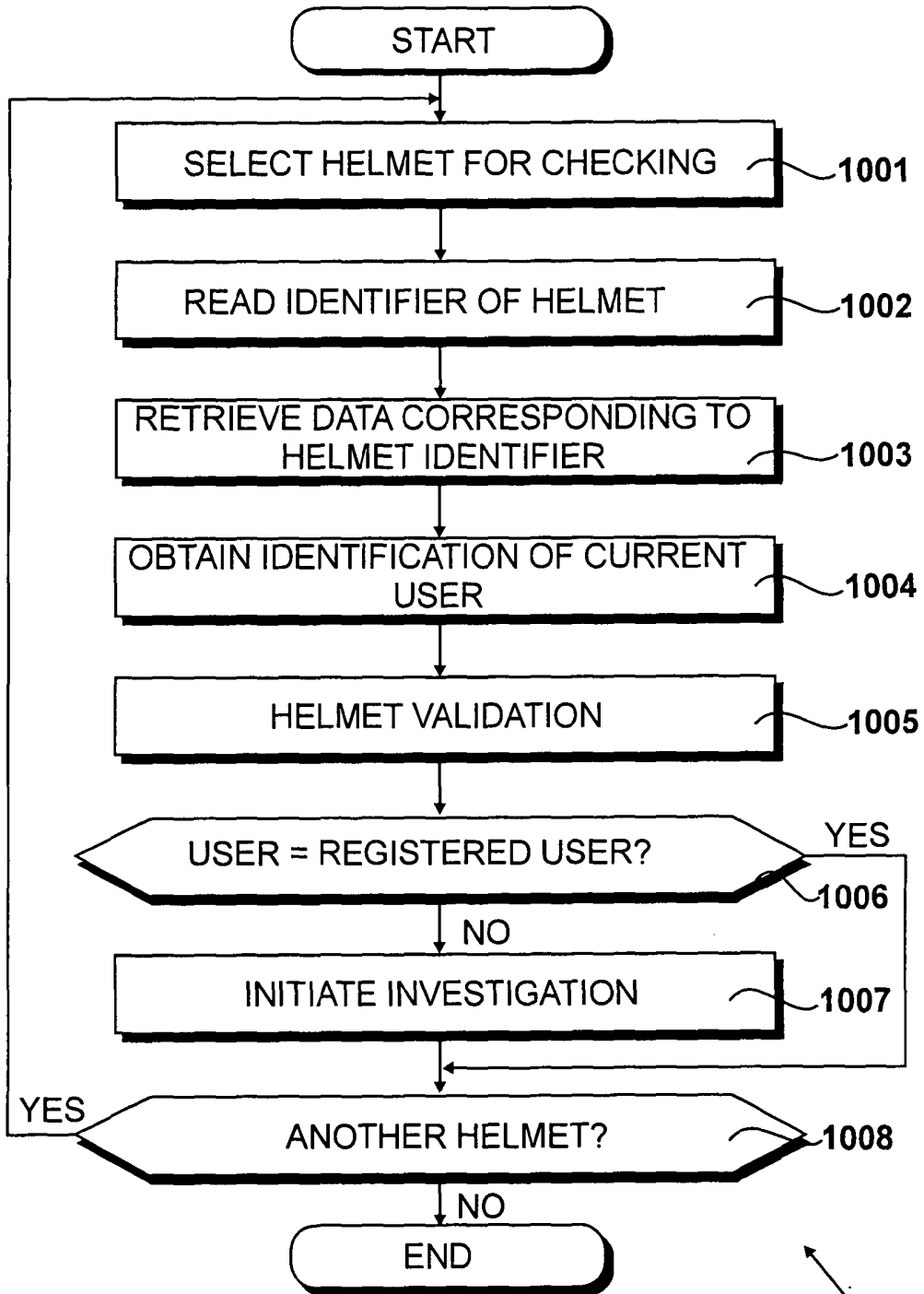


Figure 10

1000

Safety Equipment

This application represents the first application for a patent directed towards the invention and the subject matter.

BACKGROUND OF THE INVENTION

5 **1. Field of the Invention**

The present invention relates to safety equipment and a method of monitoring items of safety equipment.

2. Description of the Related Art

10 It is known for helmets used by construction workers to be moulded from a plastics material, and for a date of manufacture to be indicated on the helmet during manufacture. It is also known to withdraw such a helmet from further use after a predefined period from its date of manufacture.

BRIEF SUMMARY OF THE INVENTION

15 According to a first aspect of the present invention, there is provided a method of monitoring items of safety equipment comprising the steps of: (a) providing a unique identifier on each of a plurality of items of safety equipment; (b) storing said unique identifiers in a database; (c) inspecting a plurality of said items and reading the unique identifier of each of the inspected items; (d) for each inspected item, storing the date of inspection in said database with
20 reference to the respective unique identifier; (e) for each inspected item, monitoring a period from the date of its inspection to the present time; (f) identifying items for which said period exceeds a predetermined period and for those items repeating steps (c) to (e).

According to a second aspect of the present invention, there is provided

Safety equipment comprising: a plurality of items of safety equipment, each of said items having an attached transducer configured to provide a unique identifier under interrogation; reading apparatus for reading the unique identifier of each of said items, a data processing system comprising storage means storing said unique identifiers read by said reading apparatus, and input means for receiving indications that items relating to stored unique identifiers have been inspected, wherein said data processing means is configured to: receive unique identifiers from said reading apparatus; on receipt of an input indicating that an item has been inspected, store a date of inspection with reference to the respective unique identifier; for each inspected item, monitor a period from the date of its inspection to the present time; and identify items for which said period exceeds a predetermined period and for those items provide an output indicating that a further inspection is required.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Figure 1 shows safety equipment embodying the present invention;

Figure 2 shows a table illustrating data stored in a database on computer system 109;

Figure 3 shows a graphical user interface 301 displayed by the monitor 115 of the computer 109;

Figure 4 shows a process 401 performed by computer 109 to monitor the current status of all helmets in the database;

Figure 5 shows a flowchart of a process, "new helmet processing" 501, performed by the computer system 109;

Figure 6 shows a flowchart illustrating a helmet issuance process 600;

Figure 7 shows a flowchart outlining an audit procedure 700;

Figure 8 shows a flowchart of the process steps performed by

computing system 109 at step 701 of the audit procedure;

Figure 9 shows a flowchart of the step 703 of the audit procedure; and

Figure 10 shows a flowchart illustrating a spot check procedure 1000.

DESCRIPTION OF THE BEST MODE FOR CARRYING OUT THE INVENTION

5

Figure 1

Safety equipment embodying the present invention is shown in Figure 1. The safety equipment includes several items 101, 102, 103, 104 of safety equipment in the form of safety helmets of a type worn by construction workers. However, unlike conventional helmets of this type, each helmet 101 to 104 contains a respective transducer 105 configured to provide a unique identifier under interrogation. The transducers in the present embodiment are RFID devices (radio frequency identification devices). When manufactured, each helmet 101 to 104 is moulded such that it includes an integral pocket 106 on the interior rear wall of the helmet. The transducers 105 are then potted within the pockets 106 using a suitable compound 107, such as an epoxy resin. Helmet 104 is shown in cross-section in Figure 1, to illustrate the location of the pocket 106 and transducer 105.

The safety equipment also comprises reading apparatus, in the form of RFID reader 108, for reading the unique identifier of each of the helmets, and a data processing system in the form of a personal computer 109. In the present case, the RFID reader communicates with the computer 109 via a wired connection 110. Thus, when the RFID reader is used to interrogate RFID devices in helmets, such as helmet 104, the unique identifier provided by the device is communicated to the computer 109.

The computer 109 itself comprises conventional components including

a central processing unit 111, random access memory 112, a hard drive 113 and a CD-ROM drive 114. The computer 109 also has a conventional monitor 115 and input devices including a keyboard 116 and a mouse 117. The input devices 116, 117 allow a user of the computer system 109 to enter information
5 into the system relating to the unique identifier of the helmet. In particular, the structural integrity of the helmet may be inspected by a person trained for such a task, and on completion of the inspection, information relating to the inspection may be inputted into the system and stored in a database stored on the hard drive 113.

10 In the present embodiment, the computer 109 is connected to the internet via a modem 118, and therefore it is possible to download information relating to the manufacture of the helmets 101 to 104 from their manufacturer 120 via the internet. Alternatively, such information is dispatched on a CD-ROM 121, or similar computer readable storage device, along with the
15 helmets. It will be understood that the purchaser, and new owner, of the helmets may obtain hundreds of helmets at a time, and just four helmets are illustrated in the present example for simplicity and clarity. In cases where large quantities of helmets are obtained, and information relating to their manufacture is to be entered on the system 109, it is particularly advantageous
20 to have the facility to obtain such data by downloading or by reading from a storage device 121.

In the present embodiment, the computer system 109 is provided with a
25 loudspeaker 122 and LED (light emitting diode) array 123. The LED array and speaker are used by the computer 109 to provide clear audio and visual alarm signals during operation relating to the monitoring of helmets, such as helmets 101 to 104. Such alarm signals will be further described below.

It may be noted that for the sake of simplicity, the computer system 109

comprises a single personal computer. However, it will be understood that the processes performed by the computer system may be distributed over several computers that are in communication with one another over a network. In particular, in cases where helmets are to be inspected on a building site, for example as described below with reference to Figure 10, it may be advantageous to have a relatively light mobile computer with an associated RFID reader in communication over a radio network with a second computer containing the database.

Figure 2

A table illustrating data stored in a database on computer system 109 is shown in Figure 2. The database includes the unique identifier 201 of each helmet being monitored, a date of manufacture 202 for each helmet and the identity of the manufacturer 203. In addition, in accordance with current requirements, the helmets monitored by the system are to be disposed of after five years from their date of manufacture. Consequently, the database also contains, for each helmet, a recall date referred to in the table as "End of life" 204 after which the helmet should no longer be used. It is envisaged that the date of manufacture and identity of manufacturer is information that may be either downloaded over the internet from the manufacturer or received with new helmets on a CD-ROM.

The database also includes the owner 205 of each helmet, the surname 206 and first name 207 of the user of the helmet and the date 208 on which the helmet was issued to that user.

Helmets are currently worn by construction workers and the like without any independent monitoring of the condition of the helmet. However, in the method of the present invention, an inspector periodically inspects the

monitored helmets. Consequently, the database also contains for each helmet a date 209 when it was last inspected, the identity of the inspector 210 and the date 211 when the next inspection will become due.

5 It may be noted that, because the transducers provide a unique identifier that corresponds with an identifier stored in the database, the inspector of helmets is able to positively identify each helmet that they inspect, and view the helmet's history on the computer's display 115.

Figure 3

10 A graphical user interface 301 provided by the monitor 115 of the computer 109 is shown in Figure 3.

The computer system 109 includes a real-time clock, and software for monitoring periods from the date of inspection of each monitored helmet to the present time. In addition, operating under the instructions of the software, the computer 109 monitors the period from the date of manufacture to the present day for each monitored helmet. If a helmet is found to require immediate inspection or disposal due to reaching the end of its life, the computer generates an alert. The alert in the present example comprises displaying a symbol 302 on the display 115, illuminating an LED of the array 123 and sounding an aural alarm via loudspeaker 122.

20 The graphical user interface 301 also provides a graphical representation 303, 304, 305, 306, 307 of routines that the computer is able to perform when selected, for example by mouse cursor 308. Thus, the user is able to provide an input to the computer such that it performs "new helmet processing", "helmet issuance", "helmet audit", "helmet spot check" or
25 "emergency identification".

"New helmet processing" is performed when details of helmets not

currently on the database are to be added.

"Helmet issuance" is performed when a helmet is to be issued to a new user, and allows further details relating to the issued helmet to be added to the database.

5 "Helmet spot check" is performed during an on the spot check of helmets currently being worn by users.

The use of these routines will be further described below.

The database primarily contains information relating to the items of safety equipment, i.e. in this case the helmets. However, as the database also
10 contains information relating to the users of the helmets, it may also be useful when a helmet's user is the subject of an accident. For example, if a helmet user has an accident, such as a fall, and becomes unconscious, the RFID device in the helmet may be interrogated by an RFID reader such as reader 108. The "emergency identification" routine receives the unique identifier
15 obtained from the RFID device, retrieves corresponding data from the database and displays the name of the helmet user, along with details of their emergency contact.

Figure 4

A process 401 performed by computer 109 to monitor the current status
20 of all helmets in the database is shown in Figure 4. The process 401 is performed daily and reviews the status of each helmet in turn. Thus at the start of the process the first helmet is selected from the database at step 402. At step 403 it is determined whether the helmet is still within the validation period following its last inspection. That is, it is determined whether the date of next
25 inspection for the helmet is today or already passed. If it is determined that the validation period has ended, then at step 405 the details of the helmet are

stored for later display, and at step 406 an alarm is generated. (Thus, for example, the "red alert" is displayed on monitor 115, an LED of array 123 is illuminated and an audible alarm is periodically sounded.) The process then enters step 407.

5 Alternatively, if at step 403 it is determined that the helmet is still within a validation period following its most recent inspection, the process enters step 404 where it is determined whether the helmet life has reached the end of its usable period. That is, the process determines if today's date is more than a predetermined period, such as five years, after the date of manufacture. This
10 may be determined with reference to the stored date of manufacture 202 or the "End of life" date 203 for the helmet. If the helmet has reached the end of its usable period the process enters step 405 where the details of the helmet are stored for later display before an alert is displayed at step 406. The process then enters step 407. If, at step 404, the helmet is found to be within
15 its usable period, then the process enters step 407 directly.

 At step 407 it is determined whether other helmets in the database are still to be assessed, and if so then the next helmet is selected at step 402 and steps 403 to 406 are performed as is appropriate. When it is determined, at step 407, that the status of all helmets in the database has been assessed
20 then the process 401 ends.

 In cases where that process 401 has issued a red alert, it is then possible for the user of the computer system 109 to discover the helmets that are no longer valid. On receipt of an appropriate input from the user, such as by using the mouse cursor 308 to click on the red alert symbol 302, the
25 computer displays a list of unique identifiers relating to the helmets that have been identified as either being outside of their validation period or at the end of their usable life. Other information may also be displayed along with the

unique identifier, such as the name of the owner 205 and user 207, 208 so that the helmet may be located and either inspected and/or disposed of.

Figure 5

When new helmets are to be added to the database, possibly because a new batch of helmets has been bought by a company subscribing to the monitoring system, the user of computer system 109 provides an input to the computer to indicate that new helmet processing is required.

On receipt of a user-input that new helmet processing (303) is required, the computer performs a process 501 as shown in the flowchart of Figure 5. Firstly at step 502 the computer firstly receives an input from the user indicating whether the information relating to the new helmets has already been stored on a data storage device such as CD-ROM 121. If so, then the data is read from the device at step 503 and the process 501 ends. Alternatively, the process enters step 504 where the computer receives a user-input indicating whether information relating to the new helmets is to be downloaded. If so, the information is downloaded at step 505 before the process 501 ends.

As a final alternative, information relating to the new helmets is manually input at step 506. This step involves, for each helmet, reading the unique identifier 201 using reading apparatus 108, and entering basic information relating to the helmet. The basic information includes date of manufacture 202 and name of the manufacturer 204. Such information may be provided to the purchaser of the helmets as printed text, but alternatively, at least an approximate date of manufacture may be obtained from a date stamp moulded into the helmet at the time of its manufacture.

Figure 6

Once the basic information of a helmet has been inputted into the database at step 501, the helmet may be issued to a person requiring the use of a new helmet. However, a helmet issuance process is performed at least
5 partly by a helmet inspector before the helmets new user is able to use the helmet. The helmet issuance process 600 is shown in Figure 6.

Firstly, a helmet is selected for issuance a step 601. The helmet identifier is read using reading apparatus 108 at step 602 and the helmet is inspected for defects at step 603. The helmet inspection includes visual
10 inspection for defects such as indentations, abrasions, cracks, discoloration, damage to webbing, etc.

Following inspection, if it is determined at step 604 that the helmet failed the inspection then the helmet is disposed of at step 605, the database is updated accordingly and the steps 601 to 604 are repeated with a different
15 helmet.

When the outcome of the inspection is positive, the database is updated at step 606. This is performed by reading the unique identifier 201 using reading apparatus 108 and then manually entering appropriate information using input device 116, 117. For example, the inspection date 209,
20 the date that the next inspection is due 211, the inspector's name 210 and the names 206, 207 of the new user of the helmet are entered into the database.

A helmet having passed its inspection is then issued at step 607.

Figure 7

In order to provide an efficient monitoring system for items of safety
25 equipment, the present method envisages performing a regular audit of helmets. During an audit, items that are about to come to the end of their

validation period are inspected. For example, monitored helmets may be inspected as part of a three-monthly audit, but the inspection may take place within a specified period, such as two weeks, at the end of the three-month validation period following an inspection.

5 The outline of the audit procedure 700 is shown in the flowchart of Figure 7.

 Firstly, at step 701 a user of computer system 109 provides an input indicating that helmet audit (305) is to be performed. In response, helmets are identified by the computer system 109 that require inspection or, in the case of
10 old helmets, disposal.

 At step 702 the helmets identified at step 702 are located using information received from the computer's database. A validation process is then performed at step 703 for each identified helmet.

Figure 8

15 The process steps performed by computing system 109 at step 701 are shown in the flowchart of Figure 8.

 At step 801 the first helmet in the database is selected, and at step 802 it is determined if the end of the helmet's validation period is imminent. If the validation period has ended, or is about to end, then details of the helmet and
20 the helmet's user are displayed at step 804 before step 805 is entered.

 If the end of the validation period is not imminent, it is determined at step 803 if the end of the helmet's usable life is imminent. For example, the monitoring system for the purposes of safety and efficiency may be designed to retire helmets that are within a predetermined period from the end of their
25 life. In one embodiment, this predetermined period is chosen to be equal to the period between audits.

If the end of the helmet's life is found to be imminent at step 803 then details of the helmet and its user are displayed at step 804, before step 805 is entered. Alternatively, step 805 is entered directly where it is determined whether there is another helmet whose status is to be assessed, and if so step 801 is entered where details of the next helmet are retrieved and steps 802 to 805 are repeated as is applicable.

Steps 801 to 805 are repeatedly performed until all helmets in the database have been assessed and details of all helmets to be inspected or disposed of have been displayed.

10 **Figure 9**

The step 703 of validating a helmet is shown in Figure 9. At step 901 a helmet awaiting validation is selected, for example by an inspector. At step 902 the unique identifier of the helmet is read using reading apparatus 108 and information relating to the helmet is retrieved from the database. At step 903 it is determined whether the end of the helmet life is imminent, and if so the helmet is disposed of and the database is updated at step 907. A replacement helmet is then issued at step 908, in accordance with procedure 600 described above, to replace the retired helmet.

Alternatively, if at step 903 it is determined that the end of the helmet's life is not imminent, it is determined whether the helmet is within a valid validation period at step 904, and if not then the helmet is inspected at step 905. If the helmet is found to pass the inspection then the database is updated at step 909 to complete validation for that helmet. The updated data includes the date of the current inspection 209, the inspector 210 and the date of the next inspection.

If the helmet does not pass its inspection at step 905 then it is disposed

of at step 907 and the database updated to show that the helmet has been retired. A replacement helmet is then issued at step 908 in accordance with the above-described procedure 600.

Figure 10

5 The above-described monitoring process will only be effective and efficient if the users of the helmets use the correct monitored helmet. For example, the whole monitoring procedure would become pointless if users used non-monitored helmets. In addition, the audit process would be hindered by users not wearing helmets that are specifically assigned to them.
10 Consequently, the present monitoring method also includes a spot check procedure shown in the flowchart of Figure 10.

 It is envisaged that the procedure will be performed at a suitable entrance to a construction site or other location where helmet users must pass by with their helmets.

15 At step 1000 of the spot check procedure, the user of the computer system 109 provides an input to indicate that a spot check is to be performed. At step 1001 a helmet is selected for checking, possibly by stopping the user as they enter the building site. The unique identifier of the helmet is read at step 1002 using reading apparatus 108, and data corresponding to the unique
20 identifier is retrieved from the database. Identification is obtained directly from the wearer of the helmet at step 1004, this step may simply involve asking the wearer for their name or also asking the wearer for their signature.

 At step 1005 the helmet is validated in accordance with the validation procedure described above with reference to Figure 9.

25 Following validation, it is determined whether the identification provided by the wearer matches that of the user as registered in the database. If there is

not a match then an investigation may be initiated at step 1007 to determined why the incorrect helmet was being worn, where the user's monitored helmet is, etc. If necessary, a new helmet is issued so that the worker can continue work with a validated helmet.

- 5 Following step 1007 or step 1006, if the wearer is wearing the correct monitored helmet, the user of computer system 109 provides an input at step 1008 indicating either that a further helmet is to be, or is not to be checked. The steps 1001 to 1007 are then repeated for one or more other helmets as required.

Claims

1. A method of monitoring items of safety equipment comprising the steps of:

5 (a) providing a unique identifier on each of a plurality of items of safety equipment;

(b) storing said unique identifiers in a database;

(c) inspecting a plurality of said items and reading the unique identifier of each of the inspected items;

10 (d) for each inspected item, storing the date of inspection in said database with reference to the respective unique identifier;

(e) for each inspected item, monitoring a period from the date of its inspection to the present time;

15 (f) identifying items for which said period exceeds a predetermined period and for those items repeating steps (c) to (e).

2. A method according to claim 1, wherein said step (a) comprises attaching to each of a plurality of items of safety equipment a transducer configured to provide said unique identifier under interrogation.

20

3. A method according to claim 2, wherein each said transducer is a radio frequency identification (RFID) device.

25 4. A method according to any one of claims 1 to 3, wherein said items of safety equipment comprise safety helmets.

5. A method according to any one of claims 1 to 4, wherein said

method further comprises the steps of:

for each said item of safety equipment, storing at least one of (a) a date of manufacture of the item and (b) a recall date calculated from the date of manufacture of the item; and

5 identifying an item for which a recall date has passed.

6. A method according to claim 5, wherein said method further comprises the step of generating an alarm indicating that an item has been identified for which a recall date has passed.

10

7. A method according to claim 6, wherein said alarm comprises a visual alarm.

8. A method according to claim 6 or claim 7, wherein said alarm
15 comprises an aural alarm.

9. A method according to any one of claims 6 to 8, wherein said step of storing at least one of (a) a date of manufacture and (b) a recall date comprises at least one of (i) reading data from a computer readable device
20 and (ii) downloading data.

10. A method according to any one of claims 1 to 9, wherein each said item has a validation period of defined duration following its most recent inspection, and said items are identified at step (f) before the expiration of said
25 validation period.

11. A method according to any one of claims 1 to 10, wherein said

method comprises performing a spot check to determine whether a selected sample of users of monitored items are currently using monitored items assigned to them, wherein said spot check includes reading unique identifiers from items being currently used by said sample of users.

5

12. Safety equipment comprising:

a plurality of items of safety equipment, each of said items having an attached transducer configured to provide a unique identifier under interrogation;

10 reading apparatus for reading the unique identifier of each of said items,

a data processing system comprising storage means storing said unique identifiers read by said reading apparatus, and input means for receiving indications that items relating to stored unique identifiers have been inspected,

15

wherein said data processing means is configured to:

receive unique identifiers from said reading apparatus;

on receipt of an input indicating that an item has been inspected, store a date of inspection with reference to the respective unique identifier;

20 for each inspected item, monitor a period from the date of its inspection to the present time; and

identify items for which said period exceeds a predetermined period and for those items provide an output indicating that a further inspection is required.

25

13. Safety equipment according to claim 12, wherein said items of safety equipment comprise safety helmets.

14. Safety equipment according to claim 12 or claim 13, wherein each said transducer is a radio frequency identification device.

5 15. Safety equipment according to any one of claims 12 to 14, wherein said storage means stores for each said item of safety equipment at least one of: (a) a date of manufacture; and (b) a recall date determined from said date of manufacture, and

 said processing means is configured to identify items for which a recall
10 date has passed.

 16. Safety equipment according to any one of claims 12 to 14, wherein said storage means stores for each said item of safety equipment at least one of: (a) a date of manufacture; and (b) a recall date determined from said date
15 of manufacture, and

 said processing means is configured to identify items for which a recall
date has passed and to generate an alarm when such an item is identified.

 17. Safety equipment according to any one of claims 12 to 16, wherein
20 said data processing system comprises a data reading means configured to read data from a computer readable medium and thereby store data containing at least one of (a) a date of manufacture and (b) a recall date for a plurality of said items of safety equipment.

25 18. Safety equipment according to any one of claims 12 to 16, wherein said data processing system is configured to download data over a network and thereby store data containing at least one of (a) a date of manufacture

and (b) a recall date for a plurality of said items of safety equipment.

19. A method of monitoring items of safety equipment substantially as herein described with reference to the accompanying Figures.

5

20. Safety equipment substantially as herein described with reference to the accompanying Figures.

Application No: GB0808606.8

Examiner: Dr Russell Maurice

Claims searched: 1-18

Date of search: 15 September 2008

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-18	WO 2007/146735 A1 (DB IND INC) see eg paragraphs 7-10 & 50
X	1-18	US 2001/047283 A1 (MELICK BRUCE D ET AL) see eg paragraphs 45-48, 72, 75 & 76

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X:

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Worldwide search of patent documents classified in the following areas of the IPC

G06K; G06Q

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
G06Q	0010/00	01/01/2006
G06K	0019/077	01/01/2006