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(54) METHOD OF OPERATING A NETWORL WITH A PROGRAMMABLE BATTERY AND PROGRAMMING SAME

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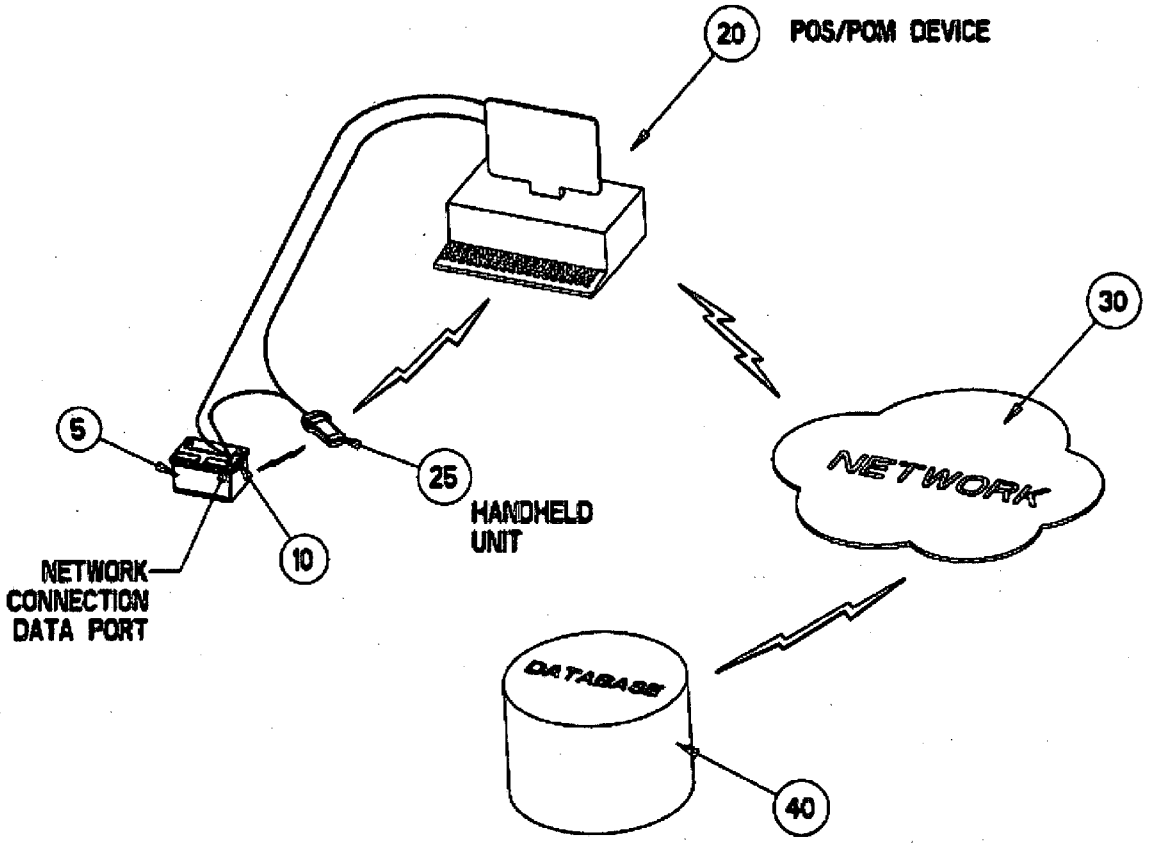
(57) **ABSTRACT**

A method of operating a network for tracking and storing warranty information and metrics of a programmable battery and programming the programmable battery, the method comprising executing a diagnostic check of the programmable battery, storing sales or maintenance specific programming, activation, and configuration data for the programmable battery in a memory coupled to the programmable battery through at least one point of sale/point of maintenance device, searching the network for software updates and product enablement data for the programmable battery and communicating information stored in the memory to a database through the point of sale/point of maintenance device and the network.



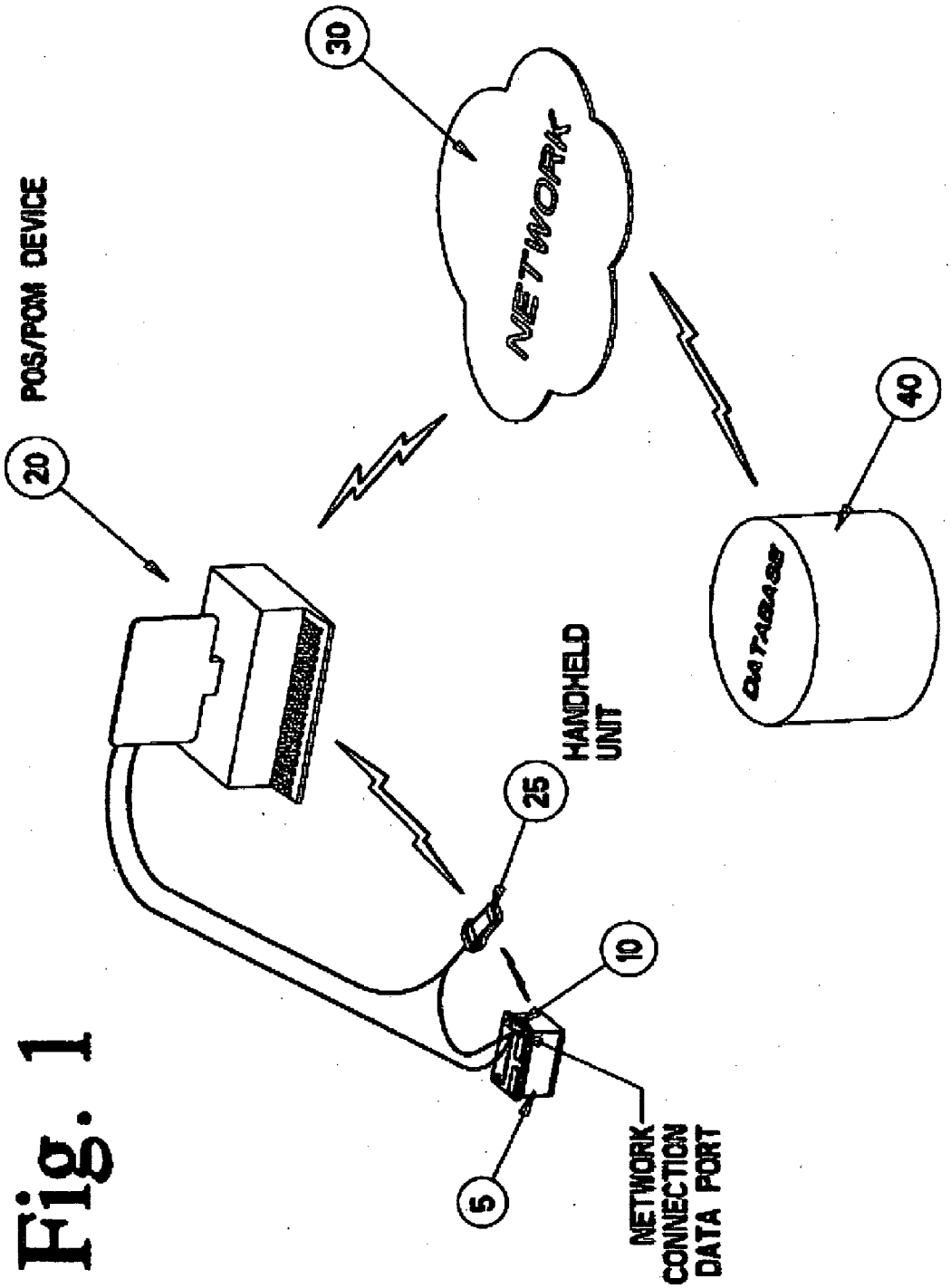

30
NETWORK
40
DATABASE
20
POS/POM DEVICE
HANDHELD UNIT
25
10
5
NETWORK CONNECTION DATA PORT

Fig. 1

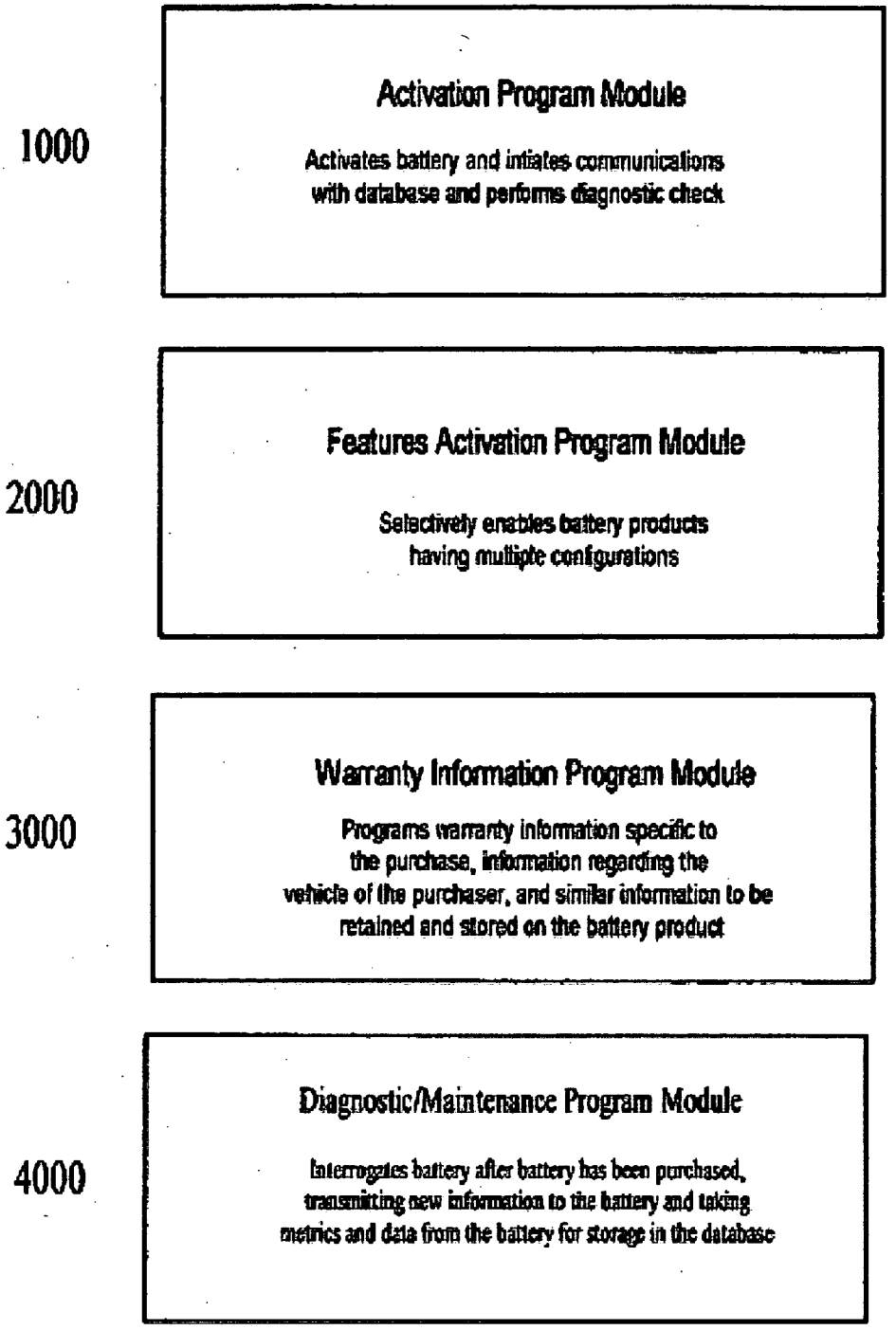

1000
Activation Program Module
Activates battery and initiates communications with database and performs diagnostic check
2000
Features Activation Program Module
Selectively enables battery products having multiple configurations
3000
Warranty Information Program Module
Programs warranty information specific to the purchase, information regarding the vehicle of the purchaser, and similar information to be retained and stored on the battery product
4000
Diagnostic/Maintenance Program Module
Interrogates battery after battery has been purchased, transmitting new information to the battery and taking metrics and data from the battery for storage in the database

Fig. 2

METHOD OF OPERATING A NETWORL WITH A PROGRAMMABLE BATTERY AND PROGRAMMING SAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Divisional Application of pending U.S. patent application Ser. No. 11/392,620, filed Mar. 30, 2006, entitled "TAMPER RESISTANT BATTERY AND BATTERY WARRANTY AND PERFORMANCE TRACKING SYSTEM."

FIELD OF THE INVENTION

[0002] The invention relates to a method, article of manufacture, and a system for tracking and monitoring warranty and performance information for batteries, more specifically to a system including at least one of a database, a computer network, a point of sale/point of maintenance device, and an electronics package on a battery product working to store information on the battery and extract information from the battery.

BACKGROUND OF THE INVENTION

[0003] The automotive industry has been one of the leading innovators in the world throughout the last hundred years. As a leader in advanced technologies, automakers have consistently incorporated state of the art technology into the vehicles we drive. From the analog world of the early twentieth century, the automobiles of today have increasingly incorporated high technology electronics to provide enhanced functionality, ease of use, and ease of maintenance.

[0004] However, current battery technologies have lagged far behind this modernization curve. Little impetus has been provided to improve battery technologies beyond advancing some of the chemistry and physical properties within the battery. Nonetheless, as the myriad of technological advances have been incorporated into automobiles, the need for reliable electrical power has also increased—and the battery remains at the heart of providing that power. To supply that power in a more reliable fashion, innovative smart batteries and smart multiple battery systems have been or are being developed by automakers and battery manufacturers alike.

[0005] Devices like U.S. Patent Application Number 2005/0038614 Botts et al. shows a remote battery monitoring system and sensors in which a plurality of telesensors are connected to batteries in a battery string. The telesensors measure battery data such as voltage, current, and temperature and wirelessly transmit the battery data to a control and collection unit. The control and collection unit receives, processes, analyzes, and stores the battery data. Remote monitoring software running on the control and collection unit can be configured to provide warning alarms when the battery data is outside present limits.

[0006] Another example is U.S. Pat. No. 6,456,036 to Thandiwe, which provides for a smart battery that has a network communication interface such that the battery can send and receive battery-related data. The battery is in conductive and communicative interface with a device, such as a cellular telephone, personal digital assistant (PDA), or laptop computer, which has a network communication pathway that the battery uses for data exchange. The smart battery can alternately be in conductive and communicative interface with a charger that is interfaced with a computer, and the charger selectively establishes a network communication pathway through the charger-computer interface for the smart battery to exchange data across the network. However, the system does not provide for the communication of information exchanged with the network to include storage of battery historic information, such as warranty activation/validation data and/or warranty invalidating performance information, or for the selective enablement of the battery or features of or on the battery.

[0007] Similarly, U.S. Patent Application Publication Number 2003/0197512 to Miller et al. shows a battery analyzer configured to communicatively couple to a computer network in which a processing arrangement is configured to charge and discharge the battery of each of an at least one battery arrangement via a battery interface arrangement and is configured to initiate a performance sequence. Data communication between the battery analyzer and a customer service site is illustrated in and can include for example, usage, performance, and/or technical support information of the battery arrangement to the customer service site via the computer network. The centralized computer system may store the information in a memory unit for subsequent retrieval, for example, to graph the usage and performance information and/or to perform numerical analysis on the usage and performance information. However, again, no warranty information is stored, treated, or communicated between the battery analyzer of Miller, et al., nor is there any discussion of the enablement or selective activation or deactivation of features on or in the battery.

[0008] In addition, several testers have been developed that provide for communication of battery data to remote locations. For instance, U.S. Pat. No. 6,871,151 to Bertness shows an electronic battery tester for testing a storage battery including test circuitry configured to provide a battery test output related to a condition of the battery. A memory stores an address of the battery tester, and communication circuitry transmits the battery test output formatted with the battery tester address on a communication link to a remote location. Likewise, U.S. Pat. No. 6,784,637 to Raichle et al shows a method and apparatus that allows a battery charger/tester to store and retrieve information from a storage media. Information, such as the result of the charge and testing of the battery, can be stored on the storage media. Additionally, information, such as firmware updates, can be uploaded from the storage media And again, U.S. Patent Application Publication Number 2006/0006876 shows an electronic battery tester and method that includes generating battery test data from an electronic battery test. The battery test data is transmitted over a wireless communication medium. In another aspect, a method and apparatus is provided for receiving battery test data from a wireless communication medium. Also, a diagnostic battery charger is also provided, which is capable of transmitting battery condition information to an external receiver. Yet still, no specific discussion of warranty information is suggested in any of these references as being transmitted and stored for tracking warranty related claims, nor is there any discussion of selective activation or deactivation of features on or in the battery.

[0009] These improved technologies come with every increasing costs to both the customer and the manufacturer. As the batteries become more advanced, the replacement costs for meeting warranty obligations for manufacturers increases. Moreover, the cost of recalls and failures in designs that might reduce battery life make this replacement cost even

greater. Additionally, smart batteries will increasingly provide a wider and wider range of functionality and become more feature rich. A system for providing control over the software and hardware enablement of the batteries is needed.

[0010] Therefore, there exists a need to provide a system whereby information can be programmed into a smart battery and this information can be centrally stored for use by maintenance providers and manufacturers.

[0011] There exists a further need to provide an onboard programmable component of a smart battery that is capable of both receiving data at point of sale and receiving data at point of maintenance while also allowing for communication of this data to a centralized data network. Additionally, in receiving this data, the smart battery must be capable of disabling and/or enabling both software and hardware on the battery.

SUMMARY OF THE INVENTION

[0012] An object of the invention is to provide a smart battery together with a warranty and metrics tracking system whereby information can be programmed into a smart battery and, at the same time, that information can be centrally stored for use by maintenance providers and manufacturers.

[0013] An object of the invention is to an onboard programmable component of a smart battery that is capable of both receiving data at point of sale and receiving data at point of maintenance while also allowing for communication of this data to a centralized data network. Additionally, in receiving this data, the smart battery must be capable of disabling and/or enabling both software and hardware on the battery.

[0014] The invention includes an article of manufacture, an apparatus, a method for making the article, and a method for using the article.

[0015] The system of the invention includes a computer system including a computer-readable medium having software to operate a computer in accordance with the invention.

[0016] Still further, the article of manufacture of the present invention comprises a computer-readable medium embodying a computer program. For the present invention, the computer-readable medium embodying the computer program comprises program modules to control a computer to perform the method of the present invention.

[0017] Further, the apparatus of the present invention comprises a computer programmed with software to operate the computer in accordance with the present invention.

[0018] Additionally, the apparatus of the present invention includes a tamper resistant battery and electronics module.

[0019] Moreover, the above objects and advantages of the invention are illustrative, and not exhaustive, of those that can be achieved by the invention. Thus, these and other objects and advantages of the invention will be apparent from the description herein, both as embodied herein and as modified in view of any variations that will be apparent to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Embodiments of the invention are explained in greater detail by way of the drawings, where the same reference numerals refer to the same features.

[0021] FIG. **1** illustrates a plan view of the instant invention.

[0022] FIG. **2** illustrates the program modules of an exemplary embodiment of the instant invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] In describing the invention, the following definitions are applicable throughout.

[0024] A "computer" refers to any apparatus that is capable of accepting a structured input, processing the structured input according to prescribed rules, and producing results of the processing as output. Examples of a computer include: a computer; a general purpose computer; a supercomputer; a mainframe; a super mini-computer; a mini-computer; a workstation; a micro-computer; a server; an interactive television; a hybrid combination of a computer and an interactive television; a controller processor; an ASIC; and application-specific hardware to emulate a computer and/or software. A computer can have a single processor or multiple processors, which can operate in parallel and/or not in parallel. A computer also refers to two or more computers connected together via a network for transmitting or receiving information between the computers. An example of such a computer includes a distributed computer system for processing information via computers linked by a network.

[0025] A "computer-readable medium" refers to any storage device used for storing data accessible by a computer. Examples of a computer-readable medium include: a magnetic hard disk; a floppy disk; an optical disk, such as a CD-ROM and a DVD; a magnetic tape; a memory chip; and a carrier wave used to carry computer-readable electronic data, such as those used in transmitting and receiving e-mail or in accessing a network, such as the Internet or a local area network ("LAN"); and any storage device used for storing data accessible by a computer.

[0026] A "computer system" refers to a system having a computer, where the computer comprises at least one computer and a computer-readable medium embodying software to operate the computer.

[0027] A "database" is a combination of software and hardware used to efficiently store data on an at least one information storage device, in an exemplary embodiment this includes storage on an information storage device comprising an at least one computer readable medium as defined herein.

[0028] A "handheld device" is a handheld device capable of receiving and processing data in a manner emulating a computer as defined herein.

[0029] An "information storage device" refers to an article of manufacture used to store information. An information storage device has different forms, for example, paper form and electronic form. In paper form, the information storage device includes paper printed with the information. In electronic form, the information storage device includes a computer-readable medium storing the information as software, for example, as data.

[0030] A "network" refers to a number of computers and associated devices that are connected by communication facilities. A network involves permanent connections such as cables or temporary connections such as those made through telephone or other communication links. In this way the network can be maintained by conventional wires or may also be provided wirelessly. Examples of a network include: an internet, such as the Internet; an intranet; a local area network (LAN); a wide area network (WAN); CAN and LIN networks; cellular networks; and any combination of networks, such as an internet and an intranet.

[0031] A "point of sale/point of maintenance device" refers to a network interface, a computer or handheld device that is used to interface with a network, a database, and/or with the electronics module of the battery product. This may be a single device or may be comprised of numerous component devices, such as a handheld device used in conjunction with a wireless network connection to a computer which then communicates with a network and, thereby, a database. The point of sale/point of maintenance device is located at the point of sale or point of maintenance and is coupled to the battery product.

[0032] "Software" refers to prescribed rules to operate a computer or similar device. Examples of software include: software; code segments; program modules; instructions; computer programs; and programmed logic.

[0033] FIG. **1** shows a plan view of the instant invention. The instant invention is directed to a battery warranty and metrics tracking network with a programmable battery product also capable of storing performance data. The components of the system include at least one of an onboard electronics module **10** on the battery product **5**; a point of sale/point of maintenance device **20** which provides communication with the battery product **5** and a data input for communicating data from and into the battery **25** and also communication of this data to a product database **40**; and a network **30** carrying relevant data for storage in the product database **40** and data and/or instructions **50** for storage on the battery product **5** and within the database **40**. Reference to a network, a database, an information storage device, a point of sale/point of maintenance device, and an electronics module is to be read as including at least one of each device that is reference to the singular includes all derivations of the plural for each feature disclosed.

[0034] The electronics module **10**, the point of sale/point of maintenance device **20**, network **30**, and database **40** further includes at least one computer-readable medium in an information storage device embodying software for implementing the invention and/or software to operate the electronics module **10**, the point of sale/point of maintenance device **20**, the network **30**, and database **40** in accordance with the invention. In an exemplary embodiment, the point of sale/point of maintenance device **20** would operate as a distributed network connected to servers for data storage and retrieval nationwide.

[0035] FIG. **2** shows a flow chart of the program modules used in the invention. In a first program module **1000**, software for activating the battery product **5** is provided via the instant invention from the database **40** through the point of sale/point of maintenance device. The system allows for programming, activation, and configuration of the battery product **5**. The battery product **5** may be any battery capable of accommodating the electronics module **10**. In an exemplary embodiment the battery product **5** is a smart battery or multiple battery system having an at least one electronics module **10** thereon. The electronics module **10** maintains the battery product in dormant state. The battery is only awoken from the dormant state by interaction with the point of sale/point of maintenance device **20**.

[0036] Effectively the instant invention provides a warranty of non-use of the battery product **5** up to the point of sale, as the battery product **5** is only activated at this time. In an exemplary embodiment, this is accomplished with a point of sale/point of maintenance handheld device **22**. The battery product activates at the time of sale as software is pushed from the handheld into the electronics module **5** of the battery warranty and metrics tracking system.

[0037] A further program module **2000** provides for activation of additional programmable capabilities on the battery product **5**. In instances where the battery product **5** has multiple programmable configurations, the specific configuration can be activated via the point of sale/point of maintenance device **20**. Software is pushed into the electronic package **5** and relevant hardware components and accessory function onboard the battery can be selectively enabled based on this software. One example of such a multiple configuration intelligent battery system or programmable battery product is applicant's INTELLICELL battery system, which can be configured for multiple feature levels as well as vehicle and geographic specific functionality. These can include, for example, but certainly are not limited to, activating specific feature rich hardware onboard the intelligent battery system, such as, but certainly not limited to, the hardware indicated in applicants co-pending U.S. patent applications Ser. Nos. 10/604,703, 10/708,739 and 10/913,334, herein incorporated by reference.

[0038] Together with the software being pushed onto the battery product, in a further program module **3000**, warranty information specific to the purchaser, information regarding the vehicle of the purchaser, and similar information may be retained and stored on the battery product **5** and, through the network **30**, within the database **40**. In an exemplary embodiment, the point of sale/point of maintenance device **20** is used to enter data into the battery product **5**. The data can include, for example, identifying information for the specific battery product **5**, including for instance, but certainly not limited too, the point of purchase, the date of purchase, a level of warranty, a time period of warranty, vehicle identifying information such as VIN number, vehicle make and model information, locale and geographic specific information, regional information, vehicle specific/manufacturer specific information, and other relevant information. This information, in portions or in its entirety, is stored on the battery product **5** and within the database **40**.

[0039] The information is pushed to the battery product **5** regarding the point of sale/warranty data and communicated, either at the time of purchase or at a later time, to the battery warranty and metrics tracking system network allowing for the storage of battery product **5** specific data into the battery product **5** and into the database **40**. The network component **30** of the battery warranty and metrics tracking system transmits this data and allows for storage of this data in the database **40** as a database of product and customer information.

[0040] In a further program module **4000**, the point of sale/point of maintenance device **20** is used during maintenance or at a location where the battery product **5** is being returned to interrogate the information regarding the warranty stored in the electronics module **10**. This information may be compared to the stored data within the database **40**. Additionally, performance data from the battery product **5** may be retrieved and transmitted via the network to the database **40**. This can include metrics regarding any of the characteristics of the battery, including voltage, amps, temperature, and similar characteristics as well as vehicle data communicated from the vehicle to the battery and event specific data that is stored based on previously stored event parameter data pushed onto the battery product **5**.

[0041] The program modules function together to provide tracking of specific information about individual battery

products. Each module can function independently of the others and there is no specific order of operation, however, in an exemplary embodiment of the instant invention the software embodying the invention is loaded throughout the network **30** into the point of sale/point of maintenance devices **20**. During the initial sale of the battery product, the first program module or activation module **1000** is activated through the point of sale/point of maintenance device **20** to program the battery product **5**. The battery product **5** is activated by the point of sale/point of maintenance device **20** activating the electronic module **10**, which runs a diagnostic check of the battery and then allows for entry of sales specific programming, activation, and configuration information for the battery product **5**. The activation module **1000** looks for software updates, which can be pushed from the database **40** to the point of sale/point of maintenance devices **20** for installation of the latest software in the battery product **5**. Likewise, the information stored on the battery product **5** is sent back to the database **40** through the point of sale/point of maintenance device **20** and the network **30** in a further step, through activation of the warranty information module **3000** as described herein below.

[0042] If appropriate, the second program module or features activation program module **2000** is activated. This module allows the point of sale/point of maintenance device **20** to selectively enable battery products **5** having multiple configurations. Depending on the desired accessories and features in the particular configuration, the battery product **5** through electronics module **10** enables the features and accessories of the particular configuration. Additional installation procedures my be required and these are noted at the point of sale/point of maintenance device **20**.

[0043] After activation and initial diagnostics, a third program or warranty information program module **3000** programs warranty information specific to the purchase, information regarding the vehicle of the purchaser, and similar information to be retained and stored on the battery product **5**. This information is similarly communicated through the network **30** back to the database **40**. In this exemplary embodiment, the point of sale/point of maintenance device **20** is used to enter data into the battery product **5**. This can be accomplished via any input device, non-limiting examples being a keyboard or touch screen. The data can include, for example, identifying information for the specific battery product **5**, including for instance, but certainly not limited to, identification of the point of sale, the date of purchase, a level of warranty, a time period of warranty, vehicle identifying information such as VIN number, vehicle make and model information, locale and geographic specific information, regional information, vehicle specific/manufacturer specific information, and other relevant information. This information, in portions or in its entirety, is stored on the battery product **5** and within the database **40**. The information is pushed onto the battery product **5** regarding the point of sale/warranty data and this information is then communicated, either at the time of purchase or at a later time, to the battery warranty and metrics tracking system network allowing for the storage in the database **40**.

[0044] After activation and programming, the battery is fully functional and operated by the purchaser. During maintenance calls or if the battery product **5** is returned for warranty purposes, the fourth or diagnostic program module **4000** can be activated. The diagnostic module can also be used at the point of sale, if further diagnostic information is desired. The diagnostic program module is run through the point of sale/point of maintenance device **20** and communicates with the electronics module **10** of the battery through a wireless or standard wired connection (note the data port). The information obtained from the battery product **5** will report all previously stored information on the battery product **5**. This information can be checked, if desired, against the records stored in database **40**. Further, information collected on the battery products **5** metrics can include historical data, especially in the case of failure. This could include operational metrics and information regarding the past and current state of the battery, and this and other stored information can be retrieved. This information is communicated to the database **40** and added to the record of the battery product **5** stored thereon. Additionally, software upgrades and other relevant new information is then transmitted back to the battery product **5** from the database **40** through the network **30** and the point of sale/point of maintenance device **20**. The information on the battery product **5** is thus maintained and a record of the performance of the battery product **5** and its service history are recorded.

[0045] This data warehousing on the database **40** provides manufacturers and distributors with heretofore unknown tracking and metrics capabilities. The data warehousing within the battery warranty and metrics tracking system allows distributors and manufacturers to analyze the data fields in the database **40** and make determinations and correlations regarding battery costs and performance and thereby adjust warranties accordingly. The data warehousing also enables faster recall notifications for potential service issues. Additionally, the data enables manufacturers to more clearly fit and enforce warranties based on regional zones and provides enhanced tracking for warranty claims, including data on metrics. This metrics tracking would provide for faster improvements in designs based on this data. For example, if warranty hits increased or maintenance data showed increased failures in cold weather regions, battery design could more efficiently be adjusted to improve cold weather performance.

[0046] In addition to the software, computers and networks comprising the tracking system, the electronics module **5** of the instant invention provides additional security in providing accurate data on warranties. Current process of date stamping the exterior is a thing of the past. Tampering with date stamping currently used for warranty tracking and management is easily accomplished in the current market. This leads to an increased numbers of fraudulent warranty claims. The electronics module **10** of the instant invention is developed in such a manner as to deter removal and/or tampering with this component. This is done to both prevent modification of the onboard data pushed onto the battery product and to prevent remanufacture/rehabilitation of the electronics module by unauthorized manufacturers. The methodology of rendering the electronics module tamper resistant can include, but are not limited to, electronics, tamper-resistant/evident markers, mechanical tamper indicators, tamper resistant software functionality (e.g. searching for an electrical connection or otherwise search for point of sale/point of maintenance device), firmware, or similar methodologies to deter tampering. The battery product **5** may, if tampered with, be disabled or an indicator may be provided to alert customers and maintenance personnel.

[0047] In an exemplary embodiment, the functionality of the battery product **5** would be disabled; however, access to

and the integrity of the stored data will be maintained and accessible via the point of sale/point of maintenance device **20** of the instant invention. The point of sale/point of maintenance device **20** will be able to access the data from the battery product **5**, either directly from the electronic module **10** or from component parts, such as, but not limited to, a secure E-PROM chip, of the electronics module **10**.

[0048] The embodiments and examples discussed herein are non-limiting examples. The invention is described in detail with respect to exemplary embodiments, and it will now be apparent from the foregoing to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and the invention, therefore, as defined in the claims is intended to cover all such changes and modifications as fall within the true spirit of the invention.

1. A method of operating a network for tracking and storing warranty information and metrics of a programmable battery and programming the programmable battery, the method comprising:

executing a diagnostic check of the programmable battery;

storing sales or maintenance specific programming, activation, and configuration data for the programmable battery in a memory coupled to the programmable battery through at least one point of sale/point of maintenance device;

searching the network for software updates and product enablement data for the programmable battery; and

communicating information stored in the memory to a database through the point of sale/point of maintenance device and the network.

2. The method of claim **1**, further comprising:

communicating warranty information specific to a purchase of the programmable battery to the database, wherein the warranty information includes at least one of information regarding a vehicle of the purchaser, identifying the programmable battery, information identifying a point of sale of the programmable battery, information identifying a date of purchase of the programmable battery, information identifying a level of warranty protection, information identifying a time period of a warranty, vehicle identifying information, a VIN number, information identifying vehicle make and model, information identifying a geographic region in which programmable battery is located product.

3. The method of claim **2**, further comprising:

communicating information previously stored in a memory coupled to the programmable battery to the database.

4. The method of claim **3**, further comprising:

comparing the information previously stored in the memory to information previously stored in the database for anomalies or results outside pre-established parameters stored in the database.

5. The method of claim **3**, wherein the information previously stored in the memory includes data collected during operation of the programmable battery, including historical data, operational metrics and information regarding past and current states of the programmable battery.

6. The method of claim **2**, further comprising:

receiving, at the programmable battery, software upgrades from the network.

7. The method of claim **2**, further comprising:

selectively enabling or disabling, through the point of sale/point of maintenance device, at least one of the programmable battery and specific features of the programmable battery.

* * * * *