

Automatic Cycle Storage System and Battery for Such System.

FIELD OF THE INVENTION

The present invention relates to automatic cycle
5 storage systems and batteries for such systems.

More specifically, the invention relates to an automatic cycle storage system including:

- a plurality of electric cycles each comprising an electric motor and operating respectively with rechargeable
10 electric batteries,
- a fixed infrastructure comprising a plurality of locking positions in which said electric cycles can be locked and at least one external control device suited for selectively allowing the locking and unlocking of the electric cycles
15 in said locking positions.

A cycle storage system such as described above could be used for example to make cycles freely available to the public by means of identification of the borrower of the cycle and possibly payment of a rental.

20 BACKGROUND OF THE INVENTION

The document EP-A-1,820,722 describes an example of such a cycle storage system in order for their rental in which the battery for each cycle is permanently attached on the cycle and recharges while the cycle is locked on the
25 receiving structure, which has the drawback that said battery is not necessarily fully recharged when the following user borrows the cycle.

SUMMARY OF THE INVENTION

The particular purpose of the present invention is
30 to remedy this drawback.

For this purpose, according to the invention, an automatic cycle storage system of the type in question is characterized in that the batteries are removable and independent of the electric cycles, with each battery
35 comprising an external electric connector,

in that each electric cycle comprises a cycle electric connector accessible to a user for connecting the external electric connector of one of said batteries to the cycle and powering the electric cycle,

5 in that each battery has a logic unit suited for determining at least one operating parameter of the battery,

and in that the system is suited for sending said at least one operating parameter to the fixed infrastructure, when
10 the battery is connected to an electric cycle locked in a locking position, where the fixed infrastructure has contact data for at least some users in memory and is adapted for automatically electronically sending operation information from said battery operating parameter to a user
15 of said battery according to said contact data.

This transmission is not necessarily systematic but is instead a function of the value of the operating parameter; for example, the system only sends said information to the user if the operating parameter shows a
20 need for maintenance or battery replacement. Additionally, this information can be sent only to certain users, for example subscribed users or users who got a special subscription for that purpose.

Because of these arrangements, each user can use
25 their own battery or in any case a battery whose charge they know, which allows them to use a cycle with a fully charged battery. Additionally, in this way it avoids the battery remaining in the cold during winter; this way the lifetime of said battery is considerably lengthened.
30 Additionally, the user receives information on the operation of the battery, for example to indicate to them whether maintenance or replacement is necessary, improving the service provided to the user.

In various embodiments of the automatic cycle

storage system according to the invention, one and/or the other of the following arrangements (they could be used independently of each other and independently of the aforementioned arrangements) could additionally be called
5 on:

- The fixed infrastructure is suited for transmitting operating information from said battery operating parameter to a user of said battery;

- The fixed infrastructure has in memory contact data for
10 at least some users and is suited for automatically sending said information electronically according to said contact data;

- Said contact data include at least a telephone number and said information is sent by radiotelephony text
15 message;

- Said contact data include at least one messaging address and said information is sent by electronic messaging;

- The battery has an identifier and the system comprises means for sending this identifier to the fixed
20 infrastructure with said at least one operating parameter, where said fixed infrastructure has in memory data about the user of the battery corresponding to said identifier;

- Said fixed infrastructure is suited for selectively unlocking or not the electric cycle as a function of said
25 identifier;

- The fixed infrastructure is suited for identifying the user of the cycle before any release of the cycle, and said fixed infrastructure is suited for sending said information to this user;

- The logic unit of the battery communicates with the
30 central electronic unit belonging to the cycle when said battery is connected to the cycle, where the central electronic unit of the cycle communicates with the fixed infrastructure at least when the cycle is locked in a

locking position;

- Said at least one operating parameter is representative of an electric energy storage capacity of the battery;

- Said at least one operating parameter is chosen among: a
5 cumulative usage time of said battery, a discharge cycle count, at least one discharge depth, at least one discharge current and an internal resistance.

Additionally, the purpose of the invention is also a removable battery that could be used in a system such as
10 described above, comprising:

- An external electric connector;

- A logic unit suited for determining at least one operating parameter of the battery and for sending said at least one operating parameter to a fixed infrastructure.

15 BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will become apparent during the following description of one of the embodiments thereof, given as a nonlimiting example, with reference to the attached drawings.

20 In the drawings:

- Figure 1 is a schematic perspective view showing an automatic cycle storage system according to an embodiment of the invention.

- Figure 2 is a block drawing showing the main electric
25 components of the cycle storage system from Figure 1.

- Figure 3 is a perspective schematic view of one of the batteries, which can be used in the system from Figures 1 and 2, with its charger.

- And Figure 4 is a perspective schematic view showing the
30 battery connected to the charger.

MORE DETAILED DESCRIPTION

In the various figures, the same references designate identical or similar items.

As shown in Figure 1, the present invention

involves an automatic storage system for cycles 1, such as in particular bicycles, which makes it possible for example to store cycles on public thoroughfares so as to make them available to the public, in particular by rental.

5 This automatic cycle storage system can comprise several cycle storage stations, one of which is shown in Figure 1. These cycle storage stations can for example be distributed in various areas of a single city. Each cycle storage station includes a central station position 2,
10 which is shown here as an interactive terminal provided with a user interface including for example a keyboard 3, a screen 4, possibly an electronic portable card reader 5 and a ticket printing device. As a variant, the interactive terminal 2 might not comprise a user interface and be a
15 simple communication gateway between the cycle storage station and a central server 8 (SERV.).

 The interactive terminal 2 communicates both with the central server 8 which manages cycle subscriptions and rentals and also with multiple locking positions 7 which
20 serve to lock cycles during storage and which could for example come in the form of locking terminals attached to the ground on the public thoroughfare and suited for each locking one cycle 1.

 Conventionally the cycle 1 comprises a chassis
25 composed of a frame supported by the rear wheel and a fork with handle bars on top and mounted on the front wheel. As shown in Figure 2, each cycle 1 can be an electrically assisted cycle comprising a connector 9a (DOCK.) to which a removable and rechargeable electric battery 9 (BATT.) can
30 be connected where the battery comprises an external electric connector 9b (Figure 3) complementary to said connector 9a.

 The connector 9a is connected in particular to a central electronic unit 10 of the cycle (CPU), for example

a controller, microprocessor or similar. The battery 9 could comprise a logic unit 9c (CTRL) such as a microcontroller or microprocessor, which could have a unique identifier in memory readable by the central unit 10
5 by means of the connector 9a or otherwise, and the central unit 10 also has memory (or can access memory) in which it can store this unique identifier. It is possible that the unique identifier of the battery, if one is provided, could be stored in a specific identification circuit readable by
10 the central unit 10, or other.

The battery additionally comprises:

- An electric rechargeable battery 21 connected to the external connector 9b by an electric connection,
- An electronic switching device 22 arranged on this
15 electronic connection and controlled by the logic unit 9c as a function of battery control information received from said battery logic unit for selectively switching between a connected state and a disconnected state respectively suited for allowing and preventing the external electric
20 connector 9b of said battery from discharging electric energy. Advantageously, the electronic switching device cuts the electrical connection between the rechargeable battery 21 and the external connector 9b in the disconnected state such that it then not only prohibits
25 discharging the battery but also recharging it.

The logic unit 9c can for example comprise:

- An output 23 to the switching device 22,
- At least one input 24 connected to the rechargeable battery 21 for receiving (measuring) at least one electric
30 operating parameter of the battery, that said logic unit 9c can store in internal or external memory (not shown),
- at least one input/output 25 connected to the connector 9b and allowing the logic unit 9c of the battery to dialogue with the central unit 10 of the cycle by means of

the connectors 9a, 9b.

Said at least one operating parameter can advantageously be representative of an electric energy storage capacity of the battery 9; it can in particular
5 involve at least one of the following parameters: cumulative usage time of the battery, number of discharge cycles, discharge depth, discharge current, internal resistance or any voltage or charge information of the rechargeable battery 21.

10 The battery 9 powers an electric motor 11 (M), for example a motor for electric pedaling assistance, that can be controlled by the central unit 10.

The electric motor is connected to one of the wheels of the cycle, for example the front wheel, and it
15 could be the type that can operate either in motor mode for driving this wheel or in generator mode for being driven by this wheel and generating electric current feeding the battery 9.

Normally, the operation of the motor 11 in motor or
20 generator mode is controlled by the central unit 10, on the basis of information it receives from sensors, in particular:

- A pedaling sensor P suited for detecting or measuring the pedaling force of the user on the pedals of the cycle,
- 25 - Possibly, a braking sensor suited for detecting actuation of the breaks of the cycle by the user,
- Possibly a tachometer (not shown) measuring the speed of the cycle.

Additionally, in the example considered here, the
30 central unit 10 can also be connected to an antitheft control device A, for example a simple button or key device whose actuation during a temporary stop of the cycle, controls the motor 11 by the central unit 10 to make the motor 11 operate in generator mode in the absence the

battery 9, which makes the use of the cycle nearly impossible and therefore dissuades theft of the cycle.

The central unit 10 can also control also at least one communication interface 10 (COM) that is suited for communication with a similar communication interface 13 (COM) belonging to each locking terminal 7. The communication interfaces 12, 13 can be of any known type and operate for example in wired mode, by induction, by radio waves or other.

10 The communication interface 13 from the locking terminal 7, for its part, communicates with an electronic central unit 14 (CPU) specific to the locking terminal 7 (microprocessor, microcontroller or other), where this central unit 14 furthermore controls an electronic lock 15 (LOCK - an example of such a lock is given for example in the document EP-A-1,820,722) suited for locking a cycle on the locking terminal 7 and communicates with at least one sensor 16 (SENS) suited for detecting the locking of the cycle on the locking terminal 7 and communication interface 17 (COM), for example a modem suited for communicating by wire 6 (Figure 1) or by short range radio connection or any other manner, with a similar communication interface 18 (COM) belonging to the aforementioned interactive terminal 2.

25 The interactive terminal 2 comprises, for its part, another central electronic unit 19 (CPU) such as a microprocessor, microcontroller or other, which communicates with the aforementioned peripherals 3-5 and also with a communication interface 20 (COM) such as a MODEM communicating by radio or wire with the
30 aforementioned central server 8.

In this system, each user preferably has their own removable battery 9 that they keep with them in particular for recharging when not using it on the cycle 1.

Advantageously, this recharging can be done by means of a dedicated electric charger 26 such as, for example, the one shown in figures 3 and 4 comprising a connector 27 complementary to the external connector 9b of the battery.

The charger 26 can for example comprise a central electronic unit 31 (CTRL) suited for communication, through connectors 9b, 27, with the logic unit 9c of the battery 9 connected to said charger.

The central electronic unit 31 of the charger can also control the electric supply circuit 28 of the charger, which can be connected to the electric grid by means of an external cable 29 and electric plug 30.

The logic unit 9c of the battery may be suited for controlling the switching device 22 of the battery as a function of battery control information exchanged between said central unit 31 of the charger and said logic unit 9c of the battery.

For example, the logic unit 9c of the battery 9 and the central unit 31 of the charger 26 can comprise identical or complementary codes serving to confirm that the battery corresponds to the charger. For example, the identifier of the battery 9 can be read by the central electronic unit 31 of the charger, which has identification data corresponding to this identifier in memory, and the central unit 31 of the charger is suited for sending, when the identifier read by the central unit 21 of the charger corresponds to said identification information, battery control information to the logic unit 9c of the battery serving to switch the switching device 22 to the connected state.

If this correspondence is confirmed, the logic unit 9c of the battery moves the switching device to the connected state and the charger 26 supplies the battery 9

through the external connector of said battery. Inversely, if this correspondence is not confirmed, the logic unit 9c of the battery sends or keeps the switching device 22 in the disconnected state, such that the switching device
5 blocks recharging of the battery. Recharging stolen batteries can thus be prevented if the thief was not able to steal a charger compatible with this battery.

This is how the device which was just described operates.

10 When a user wishes to borrow a cycle 1 from the cycle storage station, they can identify themselves at the interactive terminal 2 (by means of a card read by the card reader 5 of the interactive terminal or by pressing a personal code on the keyboard 3 or by any other known
15 means) after which the interactive terminal verifies, for example with the rental management server 8, that the user has the right to rent to cycle.

As a variant, each locking position 7 can comprise a card reader, for example a contactless card reader, that
20 can read a contactless card presented by subscribed users to identify themselves after which the locking position in question communicates with the interactive terminal 2 which requests authorization from the server as indicated above.

According to another particularly advantageous
25 variant, the subscribed user can be identified by means of their removable battery 9, which is personal to them as indicated above and whose identifier is saved by the server with the other data for the subscriber, in the subscriber database. In this case, when the user arrives at the cycle
30 storage station, the user only needs to connect their personal battery 9 on the connector 9a of the desired cycle. The logic unit 9c of the battery then communicates its identifier to the central unit 10 of the cycle, which itself communicates with the central unit 19 of the

interactive terminal 2 by means of the central unit 14 of the locking terminal 7 on which the cycle is locked. As previously explained, the interactive terminal 2 then asks the server 8 for authorization to release the cycle 1.

5 In all the cases discussed above, when it receives a request to release a cycle, the server 8 verifies whether the user has a right to rent a cycle and whether the battery 9 is on a list of stolen batteries. If the situation is normal, the server gives the interactive
10 terminal 2 authorization to release the cycle 1 and notes the rental starting time. The interactive terminal 2 then orders the release of a cycle 1 from the locking terminal 7 thereof so that the user can take it and use it.

 Inversely, when it receives a cycle release request
15 following the connection of the battery 9 on the cycle if the server detects that the identifier of the battery 9 corresponds to a stolen battery, it sends the interactive terminal 2 a battery blocking order where this order is relayed by said interactive terminal and then by the
20 central unit of the cycle to the logic unit 9c of the battery 9. The central unit 9c of the battery then switches the switching device into disconnected state and definitively keeps it in this state, unless it receives a deblocking order coming from the server or from the battery
25 maintenance service. Stolen batteries can thereby be neutralized, which is an additional dissuasion against theft. It should be noted that this battery blocking process can be used even if the identifier of the battery is not used to release the cycle: for example, in this
30 case, the user can be asked to connect their battery 9 to the cycle 1 before releasing the cycle and without that the cycle is not released.

 When the user connects their battery 9 to the connector 9a of the cycle, the switching device thereof is

initially in the disconnected state and the logic unit 9c of the battery detects the connection of the battery either directly or indirectly because the logic unit 9c starts to dialogue with the central unit 10 of the cycle. When the
5 logic unit 9c detects this connection and subject to the condition that it has not received a blocking order as explained above, the logic unit 9c orders the switching device 22 to have it switch into connected state. More generally, this command for the switching device 22 to
10 switch over to connected mode can be done as a function of any control information received by the logic unit 9c (e.g. direct detection of connection of the battery, dialogue with the central unit of the cycle or other).

This switch into connected mode could be
15 subordinated to receiving an order from the central unit 10 of the cycle. For example, the central unit of the cycle can first read the identifier of the battery, confirm that it is a valid identifier and then give the order to switch into connected mode.

20 Once the cycle 1 has been released by the locking terminal 7, the user can freely use it. When the user has finished using the cycle, the user returns the cycle to a cycle storage station (the one where the cycle was borrowed or another) by engaging the cycle 1 in an available locking
25 terminal 7 of this station. The interactive terminal 2 of this station then informs the server 8 that the cycle 1 has been returned, and then once the server confirms that the situation is in order, has the cycle 1 locked on the locking terminal 7. The user then takes back their battery
30 9.

When the user disconnects their battery 9 from the connector 9a of the cycle (at the end of use or even during a temporary stop of the cycle), the logic unit 9c of the battery detects this disconnection as explained above and

then commands the switching device 22 to have it switch over to disconnected state. Then the battery cannot be discharged unexpectedly, even if the external connector 9 thereof comes into contact with a conductor. This advantage
5 also applies if the external connector is protected in whole or part by a flap or cap or other while it is disconnected.

Additionally, the system is suited for sending the aforementioned operating parameter(s) for the battery 9 to
10 the fixed infrastructure when the battery is connected to an electric cycle 1 locked on a locking position 7, for example before the release of the cycle and/or when the cycle 1 is returned by the user. This transmission can for example be done at the same time as transmitting the
15 identifier of the battery 9. For example, the logic unit 9c of the battery communicates these data to the central electronic unit 10 of the cycle to which the battery is connected, and the central electronic unit 10 of the cycle in turn communicates said data to the fixed infrastructure,
20 for example to the locking position 7 to which it is locked, which transmits to the interactive terminal 2 which retransmits to the management server 8.

The management server 8, or any other part of the fixed infrastructure, can then send information based on
25 said operating parameter of the battery 9 to the user of the battery 9. This information can for example be information on the use of the battery, usage recommendation, information concerning maintenance or replacement of the battery, or other. To do this, the
30 server 8 (or any other part of the fixed infrastructure) can advantageously have contact data in memory for at least some users and be suited for automatically sending said information about the battery electronically, as a function of said contact data. These contact data can include at

least one telephone number and said information can be sent by a radio telephony text message (SMS, MMS or similar) to the mobile telephone 35 the user (Figure 1) or even said contact data includes at least one messaging address and
5 said information is sent by electronic messaging (email, instant message, etc.) which could be accessible to the mobile telephone 35 or by a computer.

The user to whom the information about the battery must be sent can be determined by the server 8 as a
10 function of the identifier of the battery 9, since the server 8 has data about the user of the battery in memory in correspondence with said identifier.

Alternatively, the server 8 could use only the identification data which served to identify the user in
15 order to borrow a cycle (electronic card, personal code or other), other than the identifier of the battery, in particular in the case where the battery 9 has no identifier or even if the identifier of the battery is not connected to a user in the database of the server 8. In
20 this case, the server sends said information about the battery to the user corresponding to said identification data (electronic card, personal code or other).

CLAIMS

1. Automatic system for cycle storage including:
- a plurality of electric cycles each comprising an electric motor and operating respectively with rechargeable electric batteries,
 - a fixed infrastructure comprising a plurality of locking positions in which said electric cycles can be locked and at least one external control device suited for selectively allowing the locking and unlocking of the electric cycles in said locking positions,
- wherein the batteries are removable and independent of the electric cycles, with each battery comprising an external electric connector,
- wherein each electric cycle comprises a cycle electric connector accessible to a user for connecting the external electric connector of one of said batteries to the cycle and powering the electric cycle,
- wherein each battery has a logic unit suited for determining at least one operating parameter of the battery,
- wherein the system is suited for sending said at least one operating parameter to the fixed infrastructure, when the battery is connected to an electric cycle locked in a locking position, where the fixed infrastructure has contact data for at least some users in memory and is adapted for automatically electronically sending operation information from said battery operating parameter to a user of said battery according to said contact data.
2. System according to claim 1, in which said contact data include at least a telephone number and said information is sent by radiotelephony text message.
3. System according to claim 2, in which said contact data include at least one messaging address and

said information is sent by electronic messaging.

4. System according to any one of the preceding claims, in which the battery has an identifier and the system comprises means for sending this identifier to the
5 fixed infrastructure with said at least one operating parameter, where said fixed infrastructure has in memory data about the user of the battery corresponding to said identifier.

5. System according to claim 4, in which said fixed
10 infrastructure is suited for selectively unlocking or not the electric cycle as a function of said identifier.

6. System according to any one of claims 2 to 5, in which the fixed infrastructure is suited for identifying the user of the cycle before any release of the cycle, and
15 said fixed infrastructure is suited for sending said information to this user.

7. System according to any one of the preceding claims, in which the logic unit of the battery communicates with the central electronic unit belonging to the cycle
20 when said battery is connected to the cycle, where the central electronic unit of the cycle communicates with the fixed infrastructure at least when the cycle is locked in a locking position.

8. System according to any one of the preceding
25 claims, in which said at least one operating parameter is representative of an electric energy storage capacity of the battery.

9. System according to any one of the preceding claims, in which said at least one operating parameter is
30 chosen among: a cumulative usage time of the battery, a discharge cycle count, at least one discharge depth, at least one discharge current and an internal resistance.