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Description

The invention relates to a locking system of a bicycle, in particular an e-bike, comprising an onboard computer, wherein the locking system comprises a portable lock and a mobile end device. A portable lock is understood in this context as every kind of lock which can be removed from the bicycle such as a padlock, a hoop lock or a cable lock. Portable locks in this
5 context furthermore also include frame locks or battery compartment locks which are attached to bicycles. Such portable locks are generally known.

DE 20 2016 002 087 U discloses an electronic bicycle lock comprising a locking element which can be actuated by means of an electric motor. The bicycle lock has an ID reader as an
10 authentication module which is supplied with power for a limited time after the actuation of a switch in order to enable an authentication of a suitable ID key.

An electronic locking system in accordance with DE 20 2016 002 367 U1 comprises a locking unit and an electronic control unit comprising a communication module, which can be
15 activated by means of a switch, for the wireless reception of an access code, wherein the control unit electronically actuates the locking unit on a reception of a correct access code.

A remote-controlled anti-theft protection device for a bicycle is known from CH 702 459 A2 that provides an activation and deactivation of wheel locks mounted at a bicycle or of a steel
20 cable lock by means of an actuation of a button at a mobile control device.

DE 10 2015 119 187 A1 discloses a locking apparatus for a mobile device comprising a movable blocking means, wherein the mobile device transmits a release signal to the blocking means after a positive authentication by a user. The mobile device can also be an onboard
25 computer.

A bicycle system is known from EP 3 010 791 B1 that has a processor, a smartphone holder and a locking system, wherein the smartphone holder can be configured to receive a smartphone and to connect the smartphone to the processor, and wherein the locking system
30 can be controlled by the processor.

It is the underlying object of the invention to make the use of a portable lock of a bicycle more comfortable.

A locking system having the features of claim 1 is provided to satisfy the object.

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The portable lock of the locking system in accordance with the invention comprises an unlocking motor, an authentication module for authenticating a user of the lock and an actuation element which can be actuated by the user and by means of which the unlocking motor can be activated to unlock the lock on a successful authentication of the user.

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It is the underlying idea of the invention not to unlock the lock as conventionally usual by means of a key, but instead to provide an unlocking motor which can be activated by the user. The lock is therefore an electronic lock.

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So that it is ensured that only an authorized user can unlock the lock, it additionally has an authentication module for authenticating the user. In this manner, the user no longer needs to carry a physical key with him to unlock the lock, whereby not only the comfort of use is increased, but simultaneously the risk of loss or theft of the key is also dispensed with.

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The authentication of the user ideally takes place unnoticed by the user in the background. To prevent an unintentional unlocking of the lock on a successful authentication of the user, for example when the user is located within a distance from the lock enabling the authentication, but does not intend to unlock the lock, the user therefore has to carry out a conscious action in the case of an actually desired unlocking of the lock in that he actuates the actuation element.

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In accordance with the invention, the authentication module can be activatable by attaching an onboard computer to a bicycle. In this respect, the onboard computer itself forms the actuation element, that is no additional actuation element has to be provided at the lock. This has proven to be particularly advantageous when the lock is a frame lock or a battery compartment lock of an e-bike with which the user typically removes the onboard computer and takes it with him when leaving the e-bike.

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It is understood that not only the unlocking of the lock is possible on a successful user authentication and actuation of the actuation element, but a locking of the lock is also conceivable in the same manner.

5 Advantageous embodiments of the invention can be seen from the dependent claims, from the description and from the drawing.

To be able to carry out the authentication of the user unnoticed by the user in the background, the authentication preferably takes place wirelessly. The user therefore does not need to
10 separately take out a mobile end device enabling the authentication which he carries with him for the authentication, such as a remote control, a smartphone or a smart watch, for authentication purposes, but can rather leave it in his pocket.

An embodiment is preferred, in particular when the lock is not connected to the traction battery
15 of an e-bike or of an electric scooter, for example when the lock is a removable hoop lock, padlock, cable lock or a frame lock of a conventional two-wheeler, in which the authentication module can be activated by actuating the actuation element. The authentication module can in this manner be moved into a passive state consuming no energy after ending an authentication
20 procedure or unlocking procedure to conserve an energy store of the lock. The authentication module is only woken up again so-to-say by actuating the actuation element, in particular by attaching an onboard computer to a bicycle, to perform a pairing with a mobile end device of the user that may be present in the vicinity and to carry out an authentication procedure. Depending on how fast the waking up of the authentication module, the pairing of the authentication module and the mobile end device and the actual authentication take place, the
25 lock is only unlocked with a certain time delay after actuating the actuation element in this case.

The authentication module advantageously comprises a transmission/reception unit to establish
30 a wireless connection to a mobile end device of the user. The mobile end device can be a remote control associated with the lock or also a portable computer which the user normally anyway carries with him, for example a smartphone, a smart watch or a tablet.

The wireless connection is preferably a Bluetooth connection. Bluetooth connections have in particular proven themselves with respect to range and universality.

The actuation element can be actuatable by contact or also contactlessly.

5 In each case, the communication between the onboard computer and the lock can take place wirelessly, in particular via Bluetooth, or wired, in particular via a holder for the onboard computer fastened to the bicycle.

10 In accordance with an even further embodiment, the lock comprises a sensor for detecting a movement of the lock and an alarm module which is connected to the sensor and to the authentication module and which outputs an alarm, in particular an acoustic alarm, in the event of a movement of the lock detected by the sensor and of an unsuccessful user authentication. Theft protection is substantially increased by such an alarm function.

15 The unlocking motor is preferably an electric motor. It is understood that the portable lock preferably has an energy store for supplying the unlocking motor, the authentication module and optionally the actuation element with energy. The energy store can thus, for example, be a battery respectively a rechargeable battery.

20 The invention relates to a locking system comprising a portable lock of the above-described kind; and a mobile end device by means of which a user of the lock can authenticate himself thereat. The advantages named above in connection with the portable lock apply accordingly to the locking system in accordance with the invention.

25 So that the mobile end device can communicate with the authentication module of the lock, the mobile end device advantageously also comprises a transmission/reception unit to establish a wireless connection to the authentication module of the lock.

30 As already mentioned, the mobile end device can be a remote control or a portable computer, in particular a smart watch, a smartphone, a tablet, etc.

In accordance with an embodiment, the mobile end device has an energy store by which the lock can at least be supplied with sufficient energy for an emergency unlocking. The lock can then also still be unlocked in this manner if it is itself completely without current or voltage, for example because a battery of the lock is defective or because the user has forgotten to

charge a rechargeable battery of the lock in time. In other words, the energy store of the mobile end device therefore ensures an emergency power supply/emergency voltage supply.

To implement such an emergency power/voltage supply, the lock and the mobile end device preferably have complementary connector elements by means of which the mobile end device
5 can be connected to the lock to supply the lock with energy.

The connector elements can, for example, comprise a USB plug and a USB socket.

10 In particular when the mobile end device is a remote control associated with the lock, the connector element of the mobile end device can be movable between a passive position in which it is protected in a housing of the mobile end device and an active position in which it at least partly projects out of the housing and is couplable to the connector element of the lock.

15 A further subject matter is a method of unlocking or locking a portable lock of a bicycle, in particular an e-bike, comprising an onboard computer, wherein the portable lock has an unlocking motor, an authentication module and an actuation element which can be actuated by a user and which is formed by the onboard computer, in which method the authentication
20 module is activated by attaching an onboard computer to the bicycle; an authentication of the user is carried out by means of the authentication module in that the user authenticates himself at the lock by means of a mobile end device; and in the event of a successful authentication of the user and an additional actuation of the actuation element, the unlocking motor is activated to unlock the lock. The aforesaid advantages can be achieved accordingly by the method in
accordance with the invention.

25 As already mentioned, the authentication of the user advantageously takes place wirelessly and in particular via a Bluetooth connection between the authentication module and the mobile end device of the user.

30 In accordance with an energy-efficient embodiment, the authentication module is activated by the actuation of the actuation element and the authentication of the user is only carried out after the actuation of the actuation element. In this case, the authentication module can normally adopt an energy-saving passive state and can only be woken up to carry out an authentication procedure.

Exemplary embodiments which are intended to serve for the understanding of the invention, whose scope is determined by the enclosed claims, will be described with reference to the enclosed drawing in the following. There are shown:

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Fig. 1 a schematic representation of a locking system in accordance with a first embodiment;

Fig. 2A a plan view of a remote control of the locking system of Fig. 1;

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Fig. 2B a front view of the remote control of Fig. 2A;

Fig. 2C a side view of the remote control of Fig. 2A with an extended connector element;

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Fig. 2D a side view of the remote control of Fig. 2A with a retracted connector element;

Fig. 3 a schematic representation of a locking system in accordance with a second embodiment; and

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Fig. 4 a schematic representation of a locking system in accordance with a third embodiment.

25 The locking system shown in Fig. 1 comprises a portable lock 10 in the form of a hoop lock comprising a U-shaped closing hoop 12 whose ends are received in a lock body 14 and locked therein in a locked state of the lock 10.

The locking of the closing hoop 12 in the lock body 14 takes place by means of locking
30 elements 16 which are movably supported in the lock body 14, which engage into corresponding locking recesses 18 of the closing hoop 12 and which thereby prevent the closing hoop 12 from being able to be pulled out of the lock body 14.

To unlock the lock 10, the locking elements 16 can be released, for example against the return force of locking springs which are not shown and which preload the locking elements in the direction of the locking recesses 18, from the locking recesses 18 by means of an unlocking motor 20, here in the form of an electric motor, which is arranged in the lock body 14.

5

Since the locking of the closing hoop 12 in the lock body 14 is effected by the locking springs which displace the locking elements 16 into the locking recesses 18 and since the unlocking motor 20 ultimately only provides the unlocking of the lock 10, the lock 10 is also called a semi-automatic lock 10. A fully automatic lock 10 is, however, generally also conceivable in which the unlocking motor 20 provides both the unlocking and the locking.

10

An energy store 22 is accommodated in the lock body 14 for the energy supply of the electric motor 20. In the present embodiment, the energy store 22 is a rechargeable battery which can be charged by means of a connector element, here in the form of a USB socket, which is accessible from the outside. Alternatively, however, the energy store 22 could also be a battery which can be replaced as required.

15

To trigger an unlocking procedure, an actuation element 26 which is accessible to the user is provided at the lock body 14 and is configured in the present embodiment in the form of a capacitively acting sensor surface. Alternatively, the actuation element 26 could, however, also be an optically acting or inductively acting control surface or a rotatable knob, a push button, a rocker switch or a slider switch. It is furthermore conceivable to configure the actuation element 26 in the form of a motion sensor. The actuation of the actuation element 26 would in this case take place by a movement of the lock 10.

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The actuation element 26 is connected to an authentication module 28 which is accommodated in the lock body 14 and which is in turn connected to the electric motor 20. The authentication module 28 is activated by actuating the actuation element 26 so that the authentication module 28 carries out an authentication procedure. For this purpose, the authentication module 28 first establishes a Bluetooth connection by means of a transmission/reception unit 29 to a mobile end device 30 which a user of the lock 10 carries with him for this purpose.

30

In the present embodiment, the mobile end device 30 is a Bluetooth enabled remote control (see also Fig. 2) which in turn has a transmission/reception unit 31 and which can be switched

on by means of a switch-on element 32. The remote control can also have a motion sensor, not shown, for example a 3D positional sensor, for detecting a movement of the remote control which makes it possible to wake up the remote control on detection of a movement after it has changed into an energy-saving passive state after its use.

5

Alternatively, the mobile end device 30 could, however, also be formed by a smart watch, a smartphone or another Bluetooth enabled portable computer.

10 As soon as the authentication module 28 has established a Bluetooth connection to the mobile end device 30, it carries out an authentication of the mobile end device 30. In the event of a positive authentication, the authentication module 28 transmits a release signal to the electric motor 20 so that it can move the locking elements 16 and the closing hoop 12 out of engagement for the unlocking of the lock 10.

15 If, in contrast, the mobile end device 30 is not positively authenticated, the authentication module 28 does not transmit a release signal to the unlocking motor 20, i.e. the lock 10 is not unlocked and can thus not be opened by the user. If the actuation element 26 is configured in the form of a motion sensor, the authentication module 28 can be connected to an alarm module, not shown, which outputs an alarm, in particular an acoustic alarm, to protect against
20 theft in the event of a detected movement of the lock 10 and of an unsuccessful authentication procedure.

It is understood that both the authentication procedure and the actual unlocking procedure require that the energy store 22 has sufficient energy. For the case that the energy store 22 is
25 discharged such that an authentication and/or an unlocking is/are no longer possible, the mobile end device 30 has an emergency energy store 34, for example in the form of a power bank, and a connector element 36, here in the form of a USB plug, complementary to the connector element 24 of the lock 10 to connect the emergency energy store 34 of the mobile end device 30 to the connector element 24 of the lock 10 and to charge the energy store 22 of
30 the lock 10 at least so much that the authentication can be carried out and the lock 10 can be unlocked.

To protect the connector element 36 of the mobile end device 30 from contamination and/or damage, the connector element 36 can be retracted by means of a slider 37 into a housing 38 of the mobile end device 30 (Fig. 2C) and can be extended out of it again as required (Fig. 2C).

5 A second embodiment of the locking system is shown in Fig. 3 which only differs from the above-described first embodiment in that the mobile lock 10 is here not a hoop lock, but rather a frame lock attached to a frame 40 of a bicycle 42. This frame lock also has a lock body and a closing hoop which is lockable in the lock body and which can be unlocked by means of an electric motor, with the unlocking of the closing hoop requiring, in the above-described
10 manner, a positive authentication of a mobile end device 30 after the actuation of an actuation element of the lock 10.

A third embodiment of a locking system is shown in Fig. 4 which differs from the first embodiment described with reference to Fig. 1 in that the lock 10 is not a hoop lock, but rather
15 a battery compartment lock which is attached to a frame 40 of a bicycle 42 and which serves for the securing of a traction battery 44 of the bicycle 42. To this extent, this lock 10 does not have a closing hoop, but instead a latch, not shown in any more detail, for securing the traction battery 44 received in the battery compartment 44, said latch being movable into a release
20 position by an electric motor of the lock to release the traction battery 44 as soon as a positive authentication of a mobile end device 30 has taken place after the actuation of an actuation element of the lock 10 in the above-described manner.

It is understood that a bicycle 42 can also be equipped with both a frame lock 10 of Fig. 3 and a battery compartment lock 10 of Fig. 4. It is advantageous in this case if both locks 10 can be
25 unlocked using one and the same mobile end device 30. It is, however, generally also conceivable to provide separate mobile end devices 30 for unlocking the frame lock 10, on the one hand, and the battery compartment lock 10, on the other hand.

It is further understood that when the bicycle 42 is an e-bike, the battery compartment lock 10
30 and/or the frame lock 10 does/do not necessarily have to have their own energy store 22, but can instead be connected to the traction battery 44 of the bicycle 42 for the energy supply.

Reference numeral list

	10	lock
	12	closing hoop
5	14	lock body
	16	locking element
	18	locking recess
	20	unlocking motor
	22	energy store
10	24	connector element
	26	actuation element
	28	authentication module
	29	transmission/reception unit
	30	mobile end device
15	31	transmission/reception unit
	32	switch-on element
	34	emergency energy store
	36	connector element
	37	slider
20	38	housing
	40	frame
	42	bicycle
	44	traction battery

Patentkrav

1. Låsesystem på en cykel, særligt en elcykel, med en on-board computer, omfattende en mobil lås (10) med en oplåsningsmotor (20), et autentificeringsmodul (28) til autentificering af en bruger af låsen (10) og et betjeningselement (26), der kan betjenes af brugeren, og ved hjælp af hvilket ved vellykket autentificering af brugeren oplåsningsmotoren (20) kan aktiveres til at låse låsen (10) op, og en mobil enhed (30), ved hjælp af hvilken en bruger af låsen (10) kan autentificere sig på denne,

kendetegnet ved, at

on-board computeren selv udgør betjeningselementet (26), og at autentificeringsmodul (28) kan aktiveres ved at anbringe on-board computeren på cyklen.

2. Låsesystem ifølge krav 1,

kendetegnet ved, at

autentificeringen sker trådløst; og/eller autentificeringsmodul (28) omfatter en sende/modtageenhed (29), med henblik på at etablere en trådløs forbindelse med brugerens mobile enhed (30), særligt hvor den trådløse forbindelse er en Bluetooth-forbindelse.

3. Låsesystem ifølge krav 1 eller 2,

kendetegnet ved, at

autentificeringsmodul (28) kan aktiveres ved betjening af betjeningselementet (26); og/eller betjeningselementet (26) kan betjenes ved berøring eller berøringsløst.

4. Låsesystem ifølge i det mindste et af de foregående krav,

kendetegnet ved

en sensor til detektion af en bevægelse af låsen (10) og et alarmmodul forbundet med sensoren og autentificeringsmodul (28), som i tilfælde af en bevægelse af låsen (10) detekteret af sensoren og ikke-vellykket brugerautentificering udsender en, særligt akustisk, alarm.

5. Låsesystem ifølge i det mindste et af de foregående krav,

kendetegnet ved, at

den mobile enhed (30) omfatter en sende/modtageenhed (31), med henblik på at etablere en trådløs forbindelse med låsens (10) autentificeringsmodul (28).

5

6. Låsesystem ifølge i det mindste et af de foregående krav,

kendetegnet ved, at

den mobile enhed (30) har et energilager (34), via hvilket låsen (10) kan forsynes med tilstrækkelig energi til i det mindste en nødoplåsning.

10

7. Låsesystem ifølge i det mindste et af de foregående krav,

kendetegnet ved, at

låsen (10) og den mobile enhed (30) har komplementære tilslutningselementer (24, 36), ved hjælp af hvilke den mobile enhed (30) til forsyning af låsen (10) med energi kan tilsluttes hertil, særligt hvor tilslutningselementerne (24, 36) omfatter et USB-stik og et USB-udtag.

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8. Låsesystem ifølge krav 7,

kendetegnet ved, at

tilslutningselementet (36) på den mobile enhed (30) kan bevæges mellem en passiv position, i hvilken det er beskyttet i et hus (38) på den mobile enhed (30), og en aktiv position, i hvilken det i det mindste delvist stikker ud af huset (38) og kan kobles sammen med låsens (10) tilslutningselement (24).

20

9. Fremgangsmåde til oplåsning af en mobil lås (10) på en cykel, særligt en elcykel, med en

25

on-board computer, hvor den mobile lås (10) har en oplåsningmotor (20), et autentificeringsmodul (10) og et betjeningsselement (26), som kan betjenes af en bruger, hvilket betjeningsselement udgøres af on-board computeren, ved hvilken fremgangsmåde

autentificeringsmodulet (28) aktiveres ved anbringelse af on-board computeren på cyklen,

30

der ved hjælp af autentificeringsmodulet (28) gennemføres en autentificering af brugeren, idet denne autentificerer sig på låsen (10) ved hjælp af en mobil enhed (30), og

i tilfælde af en vellykket autentificering af brugeren oplåsningmotoren (20) kan aktiveres til oplåsning af låsen (10).

10. Fremgangsmåde ifølge krav 9,

kendetegnet ved, at

- 5 autentificeringen af brugeren sker trådløst og særligt via en Bluetooth-forbindelse mellem autentificeringsmodulet (28) og brugerens mobile enhed (30); og/eller autentificeringsmodulet (28) aktiveres ved betjening af betjeningselementet (26), og autentificeringen af brugeren først gennemføres efter betjening af betjeningselementet (26).

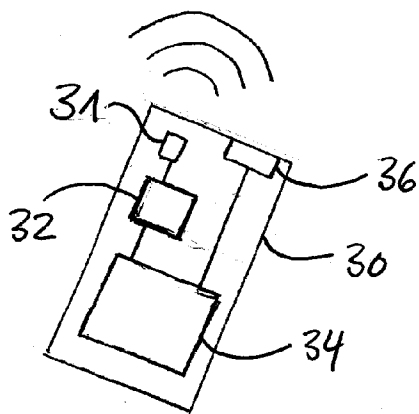
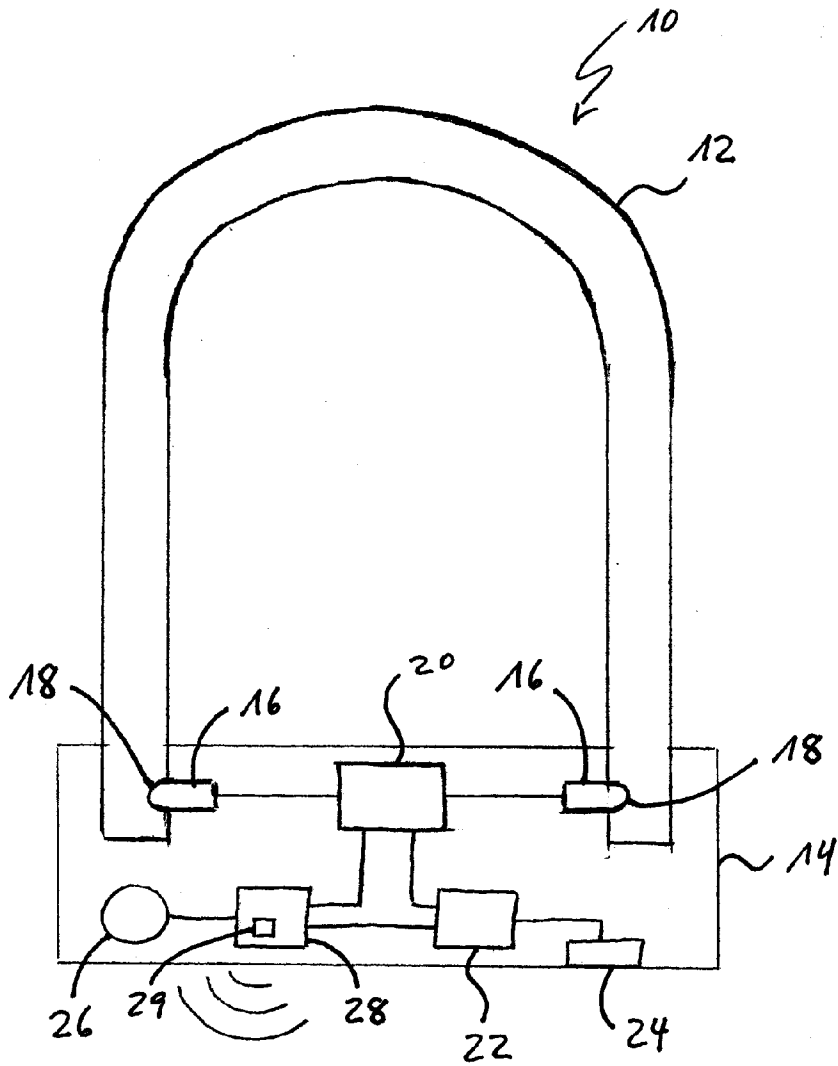


Fig. 1

Fig. 2

