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Charging cable and charging system for electric vehicles

The invention relates to a charging system for charging electric vehicles at a public charging station.

5 The infrastructure for the mobile charging of electric bicycles, e-bikes or pedelecs is still only being developed. Electric bicycles on the market have a wide variety of battery systems and charging devices adapted to them, wherein most of which are charged at home by the user. Only a few public charging stations are available for mobile charging or recharging, wherein the own home charger must be carried along for this purpose. Some known chargers need to be placed on the floor so that the battery to be charged can be inserted into a receptacle shell. This involves risks and dangers from
10 electric shock and dirt on the charger, especially outside in damp weather.

Public charging stations with integrated charging devices are also known, but the access to the charging station is reserved exclusively for those persons who also use an electric bicycle which matches the loading station. Essentially, these are mostly regional suppliers of rental bicycles, e.g. a power supply company or tourism association. All other users of electric bicycles outside this user
15 group can only charge up or recharge at such charging stations if a 240 V connection is also available at the charging station and the user carries his own home charger.

DE 195 17 117 A1 discloses a device for transmitting data, such as voltage situation, electrolyte material, etc., from an energy storage unit (battery) to a control device connected thereto, wherein the energy storage unit has means for storing the data and the control device has means for acquiring the
20 data, so that a transfer of the data from the energy storage unit to the control unit is enabled.

Furthermore, DE 10 2009 043 306 A1 discloses a monitoring system and a method for monitoring energy transfer between a first power unit and a second power unit. For example, an energy transmission takes place between a building wall socket and an electric vehicle, wherein an RFID identification unit is located in the first energy unit (building wall socket) and an RFID identification
25 receiving unit is located on the second energy unit (electric vehicle).

US 2011/0241619 A1 shows a charging system with several, distributed charging stations of a parking area for electric vehicles, in which rapid charging stations are located. At the rapid charging stations, the batteries of electric vehicles, such as electric busses, electric forklifts or even electric bicycles can be quickly charged. However, it is not possible to charge batteries with different low-voltage voltages
30 and different current intensities with the charging stations.

Furthermore, EP 2 292 460 A2 discloses a plug element for a charging cable, by means of which electrical energy can be transmitted from a charging station to an electrically operated vehicle. A data memory for storing identification information is located in the plug element. This information can be read out from the data memory and can be transferred from the plug element to the charging station.

- 5 The stored data is used to identify the user and to determine the entitlement to the energy purchase and to facilitate billing. Furthermore, information can also be given on the maximum permissible charging current to the charging station.

It is the object of the invention to develop a charging system for charging electric vehicles in such a way that it is possible for as many users of electric vehicles, in particular electric bikes, e-bikes or
10 pedelecs, to charge their vehicles in a simple manner.

According to the invention, a charging system is provided for this purpose which is characterized by the following points:

- a public charging station with a controllable device for providing different low-voltage voltages in the range below 50 volts and different current intensities, with a plurality of
15 similar plug connectors (5), for example connection sockets,
- a group of charging cables, wherein all charging cables comprise similar first plug connectors for the connection to the plug connectors of the charging station and second plug connectors adapted individually to the respective rechargeable battery of the electric bicycle for producing an electrical connection to the rechargeable battery of the electric bicycle,
- 20 - the connection of the rechargeable batteries of the electric bicycle to the public charging station by means of said charging cables for charging purposes,
- wherein a coding is arranged in the first plug connector of the charging cable, which coding can be read out by the charging station and provides technical information such as the charging cycle, charging voltage and charging current of the rechargeable battery to be
25 charged and controls the device for providing the respective low voltage and current intensity.

The major advantage of the charging system according to the invention is that it is open to different models of electric bicycles with a large variety of rechargeable battery systems. The system is also expandable at any time, as a new battery model can be integrated into the system by means of a correspondingly encoded charging cable.

In order to establish a connection with the charging station, only one charging cable has to be carried along on the electric bicycle, which means that it is not necessary to carry along a personal home charger. The charging cable can be transported by being rolled up in a saddle bag.

In the open, a plug connection to a 240 V socket does not have to be made, so there is no danger of electric shock caused by moisture on the charger.

Further advantages of the invention are explained in more detail below with reference to partly schematic drawings, wherein:

Fig. 1 shows a charging system according to the invention for charging electric bicycles, in a schematic representation;

Fig. 2 shows a first detail of an embodiment of the charging system according to Fig. 1;

Fig. 3 shows a second detail of an embodiment of the charging system according to Fig. 1;

Fig. 4 shows a charging cable of a first embodiment;

Fig. 5 shows a charging cable in a second embodiment;

Fig. 6 shows an embodiment of a charging station according to the invention.

In the following, the term "plug connector" is used to refer to the parts of a two-part, electrical plug connection which can be designed both as a plug (male part of the plug connection with outwardly pointing contact pins) and as a coupling (female part of the electrical plug connection with inwardly pointing contact openings) of a charging cable.

A charging system for charging electric bicycles is shown in the schematic illustration according to Fig. 1. At the public charging station 2 (*bike energy base*), two different rechargeable batteries 3, 3' of electric bicycles (not shown in closer detail) are connected for charging via the two charging cables 1, 1' (*docking strips*).

The upper charging cable 1 in Fig. 1 has a first plug connector 4, which is connected to a plug connector 5, e.g. a plug socket, at the charging station 2, wherein the first plug connector 4 has a coding C readable by the charging station 2, which holds the technical information (such as charging cycle, charging voltage, charging current, etc) of the rechargeable battery 3 to be charged. The same applies to the second charging cable 1', which has a similar first plug connector 4 but with a coding C which differs from the charging cable 1, which contains technical information about the rechargeable battery 3'. Optionally, additional charging cables can be connected to the free plug connectors 5 of the charging station 2.

The second, individual plug connector 6 or 6' of the two charging cables 1, 1' is connected to the different plug connectors 7 or 7' on the respective rechargeable battery 3, 3' of the electric bicycles. The plug connectors 7, 7' on the rechargeable batteries 3, 3' can be designed as plug sockets, for example.

- 5 According to a preferred embodiment, the plug connectors 5 of the charging station 2 can each be fastened to a cable which can be pulled out or rolled out of the charging station 2, as a result of which the actual charging cable 1, 1' is designed in a very short (for example only about 10 cm long) and compact manner. The low weight and the small volume of charging cable to be carried along are also advantageous. The plug connectors 5 can be pulled about 100 cm out of the charging station 2 with
10 their cables (e.g. spiral cable) and taken to the e-bike. Furthermore, a spring-loaded retractor for the roll-out cable can also be provided in the charging station 2.

The charging system thus essentially consists of the public charging station 2 with a controllable device 10 for providing different low-voltage voltages in the range below 50 volts and different current intensities, which has a plurality of similar plug connectors 5 and a group of charging cables 1,
15 1', wherein all charging cables have similar, coded plug connectors 4 for connection to the charging station 2 and second connectors 6, 6' adapted individually to the respective rechargeable battery 3, 3' (see Fig. 4 and Fig. 5).

The charging station 2 has a mains connection 15, which can be guided through the stand 16, wherein a 240 V connection 20 can additionally be provided.

- 20 Different types of coding in the first connector 4 of the individual charging cables 1, 1' are possible, for example:

a bar code, colour code, etc, which is read by an optical reading device 8 in the charging station 2,

an RFID chip readable by an electronic receiver unit 9 in the charging station 2, or

- 25 at least one additional coding pin 13 (see Fig. 3), which is connected to a corresponding capacitance, inductance or resistor 14 in the first plug connector 4, and regulates the device 10 for providing different low-voltage voltages and different current intensities.

As shown in the embodiment according to Fig. 2, the second plug connector 6' of the charging cable 1' can be designed as a plug-in card 11, which can be inserted into an electrical plug connection between
30 the motor 12 and the rechargeable battery 3' of the electric vehicle. Such a charging cable is shown in

detail in Fig. 5, wherein the plug-in card 11 is present in the form of a printed circuit board and, for example, has four contact paths (two charging contacts 17, a blanking contact 18 and a coding contact 13') which are applied to the contact pins of the motor 12 before attaching the battery 3'. This connection can also remain during the operation of the electric bicycle, so that during the charging process only the first plug connector 4 of the previously rolled-up charging cable 1' must be connected to the connector 5 of the charging station 2.

At least the plug connection of the charging cable 1, 1' to the charging station 2 and possibly also those to the rechargeable battery 3 can be designed as a magnetic plug, wherein the plug connectors 4 and 5 or 6 and 7 have permanent magnets which provide a major portion of the holding force of the plug connection. Damage to the charging cable or the charging station due to careless separation of the plug connection can thereby be minimized.

Fig. 6 shows a concrete exemplary embodiment of a compact charging station 2, in which the plug connectors or plug sockets 5 are freely accessible for the charging cables after the opening of a closure flap 19.

Due to the attachment of the coding in the charging cable 1, 1', or in the plug connector 4 of the charging cable which can be connected to the charging station 2, great advantages are obtained according to the invention since the system can be expanded as desired. Existing rechargeable batteries of electric vehicles or electric bicycles can be connected to the charging station 2 with a charging cable 1, 1' according to the invention, without having to make changes to the rechargeable battery, wherein the data relevant to the battery are kept ready for read-out for the charging station 2 in the coding of the charging cable.

Ladekabel og ladesystem til elektriske køretøjer

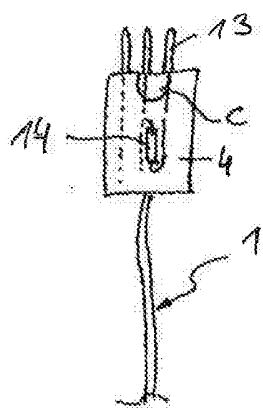
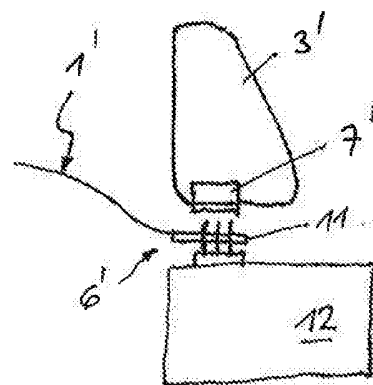
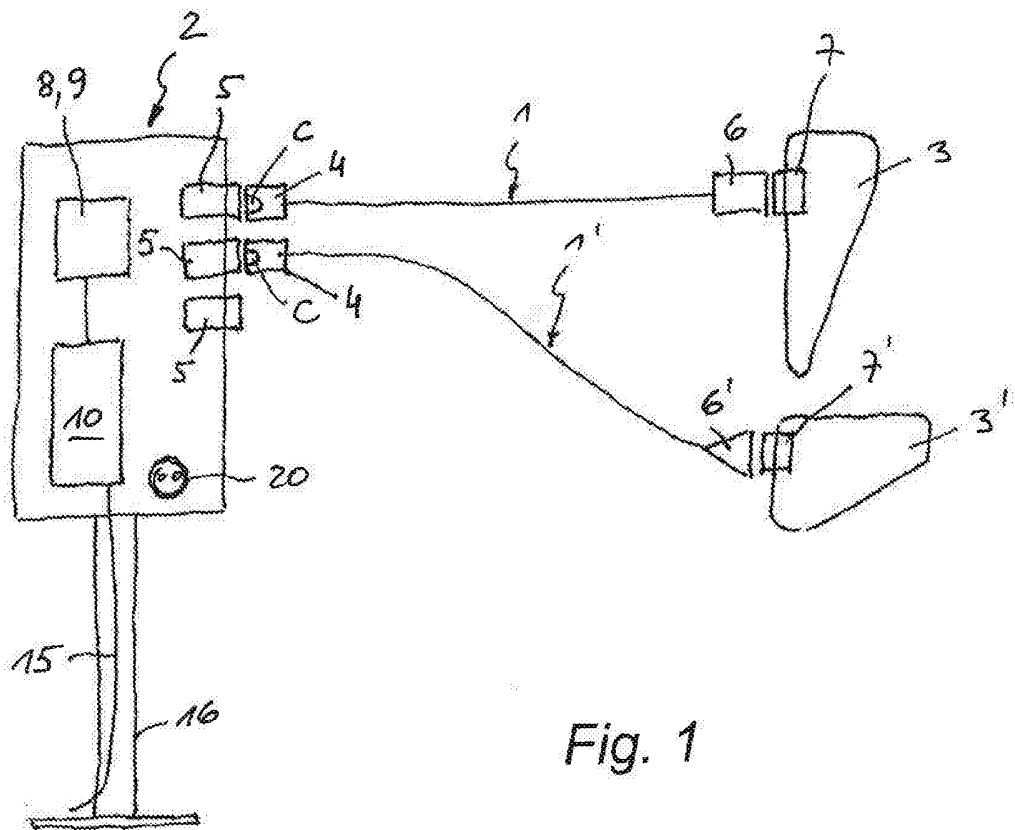
Krav

- 5 **1.** Et ladesystem til opladning af elektriske cykler ved en offentlig ladestation, **kendetegnet ved:**
- en offentlig ladestation (2) med en kontrollerbar enhed (10) til levering af forskellige lavspændinger i området under 50 volt og forskellige strømstyrker, med en lang række
 - 10 lignende stikforbindelser (5), f.eks. tilslutningsbøsninger,
 - en gruppe ladekabler (1, 1'), hvori alle ladekabler omfatter lignende første stikforbindelser (4) til tilslutning til stikforbindelserne (5) på ladestationen (2) og anden stikforbindelser (6, 6'), der er tilpasset individuelt til det respektive genopladelige batteri (3, 3') på den elektriske
 - 15 cykel til produktion af en elektrisk forbindelse til det genopladelige batteri (3, 3') på den
 - tilslutningen af de genopladelige batterier til den offentlige ladestation ved hjælp af nævnte ladekabler til opladningsformål,
 - hvor en kodning (C) er arrangeret i den første stikforbindelse (4) på ladekablet (1, 1'), hvis
 - 20 kodning kan aflæses af ladestationen (2) og giver tekniske oplysninger, f.eks. ladekredsløb, ladespænding og ladestrøm for det genopladelige batteri (3, 3'), der skal oplades, og
 - kontrollerer enheden (10) til levering af den respektive lavspænding og strømstyrke.
- 25 **2.** Et ladesystem i henhold til krav 1, **kendetegnet derved, at** den anden stikforbindelse (6') fra ladekablet (1') er designet som et indstikskort (11), der indsættes i en elektrisk stikforbindelse mellem en motor (12) og batteriet (3') på den elektriske cykel.
- 30 **3.** Et ladesystem i henhold til krav 1 eller 2, **kendetegnet derved, at** der findes en stregkode i den første stikforbindelse (4) på ladekablet (1, 1') til kodningsformål, som kan aflæses af en optisk læseenhed (8) på ladestationen (2).
- 30 **4.** Et ladesystem i henhold til krav 1 eller 2, **kendetegnet derved, at** der er placeret en RFID-chip i den første stikforbindelse (4) på ladekablet (1, 1') til kodningsformål, som kan aflæses af en elektronisk modtageenhed (9) i ladestationen (2).

5. Et ladesystem i henhold til krav 1 eller 2, **kendetegnet derved, at** der findes mindst én ekstra kodelstift (13) i den første stikforbindelse (4) på ladekablet (1, 1') til kodningsformål, som er forbundet med en respektiv kapacitans, induktans eller modstand (14) i den første stikforbindelse (4).

6. Et ladesystem i henhold til ét af kravene 1 til 5, **kendetegnet derved, at** stikforbindelsen på ladekablet (1, 1') til ladestationen (2) og efter valg til det genopladelige batteri (3) er designet som et magnetisk stik.

7. Et ladesystem i henhold til ét af kravene 1 til 6, **kendetegnet derved, at** mindst én af stikforbindelserne (5) på ladestationen (2) er fastgjort til et kabel, der kan trækkes eller rulles ud af ladestationen (2).



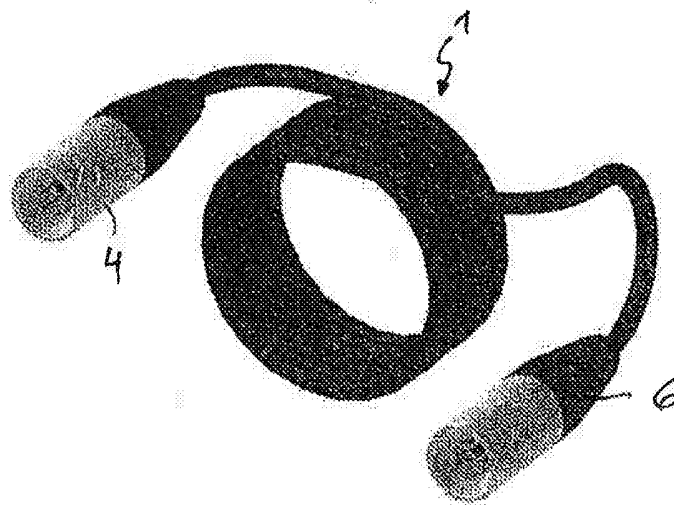


Fig. 4

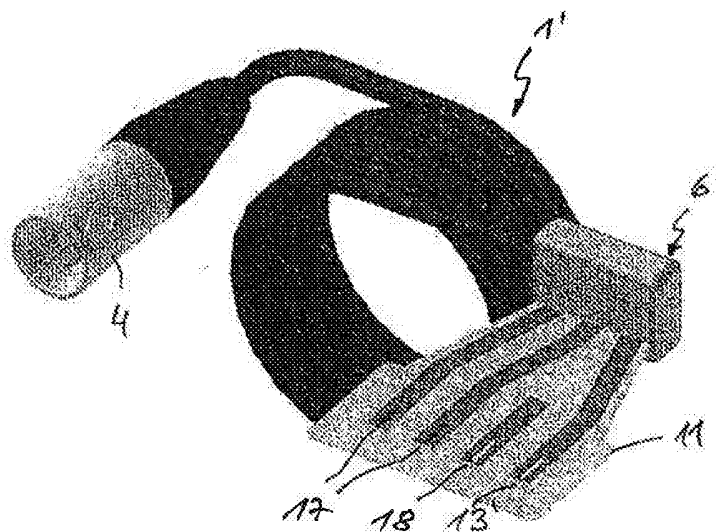


Fig. 5

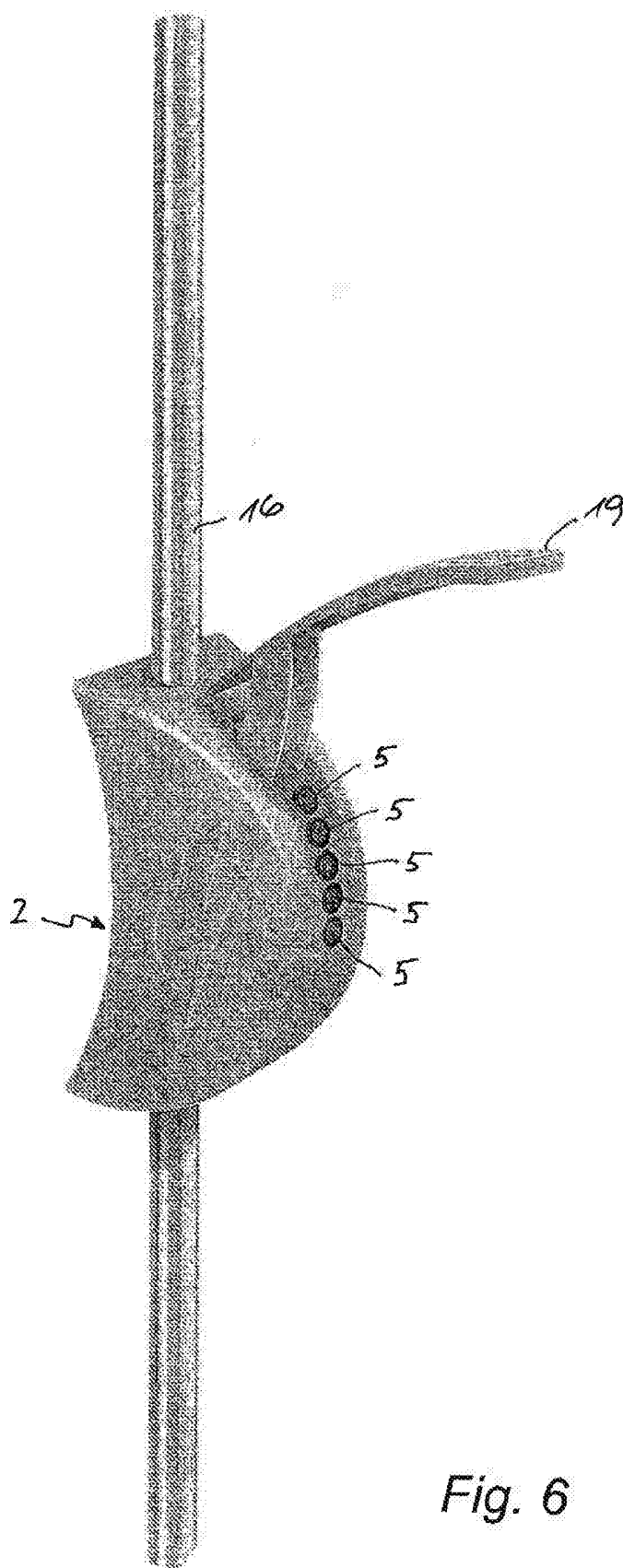


Fig. 6