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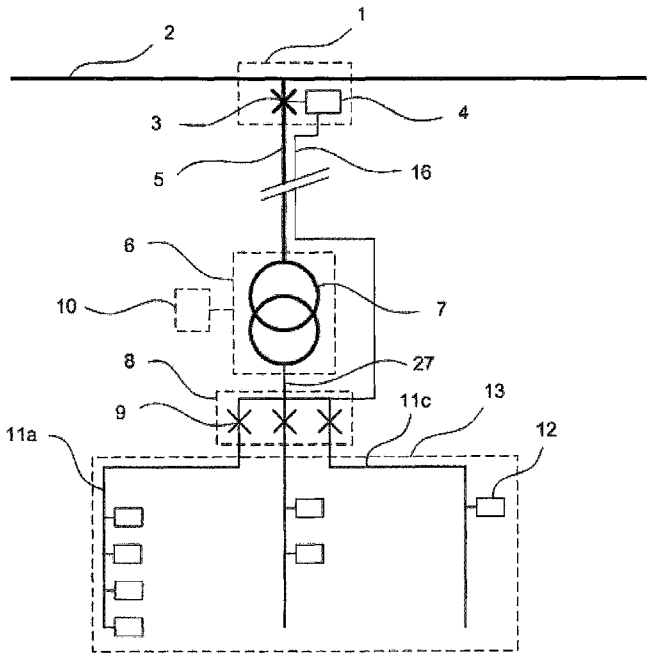

Fig 1

(57) Abstract: An installation for distribution of power to a plurality of electrically powered vehicles temporarily parked on a parking surface (13) comprising a plurality of power outlets (12), a low-voltage switchgear (8) connected to the power outlets, a transformer (7) connected to the low-voltage switchgear, and a high-voltage switchgear (1) connected to the transformer for connection to a cable-fed power grid (2). The transformer (7) is located adjacent to the parking surface, the high-voltage switchgear (1) is located adjacent to the power grid (2), and the high voltage switchgear is directly connected to the transformer (7) by a high-voltage cable (5).

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Installation for battery charging

TECHNICAL FIELD

The present invention relates to an installation for power supply to a plurality of electrically powered vehicles, such as electric cars. An electrically powered vehicle means every kind of vehicle that at any stage is powered by an electric motor and that includes a chargeable energy source. Such an energy source may for example be a battery or a capacitor arrangement. Thus, it can be an electric car such as a city car or a golf cart, or a hybrid car which also comprises a combustion engine for driving the car or charging of a battery bank. Especially, the invention relates to a power supply installation comprising a plurality of power outlets by which a plurality of temporarily connected electric cars are supplied by large amounts of energy at the same time. In particular the invention relates to such a power supply installation intended for a municipal or privately arranged parking place adjacent to a workplace, a residential area, a train station, an electric car rental, a parking garage or a similar establishment.

BACKGROUND AND PRIOR ART

Electrically powered vehicles with an energy source in the form of a battery bank have been known for a long time. Above all, such vehicles are used in environments where the exhaust from a combustion engine can not be accepted. These known vehicles are often inefficient and involve a heavy battery bank, sometimes weighing more than one hundred kilos. The development has however led to more efficient engines with effective control and to batteries that have a more favorable power to weight ratio. An increasingly stricter environmental legislation also means that an increased use of electric cars can be expected in the future.

By battery should be understood all sorts of storage media for electrical energy. The most common form is that electrical energy is converted into chemical energy. This category includes lead accumulators and batteries with nickel-cadmium, nickel-metal hybrid, lithium-ion etc. The crucial point for the application of this invention is that electrical energy can be loaded and stored in the vehicle.

From US 2007/0126395 (Sucha) an automatic charging and docking station for electric cars is previously known. The known station is intended to be placed on public or private locations and includes a vehicle-mounted probe that is brought into contact with the station, whereby charging takes place. The probe contains an identity carrier which allows the owner to be billed retroactively.

From US 5548200 (Nor et al) a universal charging station for charging of batteries for electric cars is previously known. The aim of the charging station is to allow transmission of electrical energy to a battery as quickly as possible. The problem that the charging station seeks to overcome is that drivers should not have to wait several hours or overnight to get their car charged. The known station includes a rectifier which provides a number of charging outlets with direct current. Here, the vehicle and station are arranged to communicate with each other to control the charging stage.

From US 6081205 (Williams) an electronic charging station with parking meters for electric cars is previously known. The aim of the station is to offer a publicly accessible facility for charging of electric cars. The shown station comprises a number of parking meters, each provided with a power outlet and a central control unit. The central unit and the meters are mounted in a conventional manner at a curb or a parking lot. The wiring is made below the ground. In one embodiment each of the meters comprises a display and an electrical outlet, whereas the central unit includes a keypad, a card reader and a coin slot.

A parking meter according to the known charging station shows a lockable door which in its closed position covers the outlet, thereby preventing the insertion of a plug contact. At the initiation of a payment system, a pair of locking latches are affected so that the cover is opened. In this regard, it is thus possible for a customer to connect his contact and initiate the charging. Given that the system is intended to be placed in a public place, this solution is less successful from a safety point of view. As soon as the cover is open, it is available to everyone. The risk that a child can get current through the body is then imminent. The possibility of replacing the plug contact to steal current is also evident.

The electric cars that are developed today will usually include a connection interface where an ordinary low power contact is connected to a power outlet. Usually, this includes a household current of about 230 V alternating current, but can also include, for example, three-phase alternating current. This may vary for different countries but remain within the range of 100 to 500 volts. The electric cars thus carry their own rectifiers for converting alternating current to an appropriate direct current for charging of the battery. The energy supply in the connection interface is however critical when several connected electric cars charge their batteries at the same time.

SUMMARY OF THE INVENTION

The object of the invention is to indicate ways to bring about a system for providing a high charging current to a plurality of temporarily connected electricity consumers such as electric cars.

This object is achieved according to the invention by an installation according to the features as defined in the characterising part of the independent claim 1, and by a method according to the features as defined in the characterising part of the independent method claim 9.

Advantageous embodiments are defined in the characterising parts of the dependent claims.

According to the invention, the installation comprises a plurality of power outlets for connection to temporarily parked cars and a transformer station for direct connection to a distribution network. By distribution network is to be understood a cable-fed power grid preferably between 10 to 36 kV but even up to 54 kV. A transformer station includes, in addition to a transformer, a low-voltage switchgear and a high-voltage switchgear. The transformer is located close to the electricity consumers at the parking surface. The high-voltage switchgear is located adjacent to the distribution network and is directly connected to the transformer by a high-voltage cable.

By directly connected is to be understood that the high-voltage switchgear is directly connected to the transformer without the need for additional circuit breakers. The high-voltage switchgear includes a circuit breaker which is controlled and powered via a signal cable from the low-voltage side of the transformer.

By separating or parting of the transformer and the high-voltage switchgear it is achieved that the transformer can be located close to the electricity consumers and also that the high-voltage switchgear can be connected directly to a power grid. The transformer constitutes the energy-related pressure point of the installation and its location next to the electricity consumers ensures a powerful power supply. Connecting the high-voltage switchgear directly to the distribution network means that losses which typically occur in case of long transports of low voltage may be avoided. The rating of the transformer can be 10-24/0.4 kV.

The installation according to the invention constitutes an infrastructure for charging electric vehicles when they are parked on a parking

surface. This parking surface can be an existing parking lot. It may be open or housed in a parking garage. In one embodiment the installation includes a payment system for billing of electricity consumption or the time the vehicle has been parked and charged. For this purpose, the power outlets are equipped with a lockable cover that interacts with a switch that provides current to an outlet enclosed by the cover.

The high-voltage switchgear includes a T-connection by which the high-voltage cable is connected to the distribution network. By T-connection is to be understood a connection of three equal parts, i.e. the high-voltage cables. Since it concerns cables they must be stripped and divided into phases that are connected separately. This takes place in a casing in the switchgear. The high-voltage switchgear also includes a number of circuit breaker functions, such as shortcircuit and earth fault. Functions for earth fault protection and emergency tripping are controlled and powered from the low-voltage side of the transformer. In this way, also a lower cost is obtained for the installation compared with existing ones.

By the direct connection between the transformer and the high-voltage switchgear, the high-voltage switchgear can be placed at a distance from the transformer. By distance in this context is to be understood the distance between a few tens of meters to several kilometers. For the control and power supply of the high-voltage switchgear, a signal wire is run in parallel with the high-voltage cable. This avoids the need to provide the circuit breaker of the high-voltage switchgear with a power source of its own. Such a power source, as for example a battery or capacitor device, must in fact constantly be monitored and maintained.

In one embodiment the installation comprises a transformer which is submerged below ground. The transformer is thereby placed in a caisson of for example concrete that can be prefabricated or built on

site. A cover is placed over the transformer wherein the cover comprises passageways for connection of the switchgear and the ventilation. The cover may also include an inspection hatch. In one embodiment the low-voltage switchgear is located on the cover of the caisson. In this embodiment the housing of the low-voltage switchgear also comprises fans for ventilation of the caisson. In another embodiment the ventilation is arranged separately.

The connection of the high-voltage switchgear is made in a manner that does not interfere with the distribution in the power grid. Irrespective of whether the connected circuit breaker is closed or opened, the distribution is not affected. Besides normal connections and disconnections, the circuit breaker is arranged to break upon shortcircuits and ground faults. The tripping takes place within a time delay which is shorter than the reaction time of circuit breakers in the distribution network. In this way faults that are located downstream of the T-branching will not affect the power grid. In one embodiment the measuring device of the circuit breaker and tripping device are supplied with current from the low-voltage side of the transformer. Upon an electrical fault, the secondary side of the transformer contains sufficient energy to detect the fault and trip the circuit breaker.

According to one embodiment of the invention, the installation comprises a power supply system with a plurality of power outlets for connection to a temporarily parked electrically powered vehicle. The power supply system includes a cable network that connects a plurality of power outlets to the low-voltage switchgear. A power outlet comprises a post and a connection module including one or more power outlets. The power supply system comprises in one embodiment branches of cable protection devices. The cable protection devices are secured to the parking surface and enclose the cables. In one embodiment, the cable protection devices constitute the framework or the base to the posts. Because the cables are pulled in the cable

protection devices, the cables do not need to be buried, which provides great flexibility and low installation cost. According to one embodiment, the post is anchored to the ground, whereby the posts are enclosed by a lining. The lining protects the cables that are drawn between power outlets and cable protection devices arranged at the parking surface.

According to a first aspect of the invention, the object is achieved by an installation for distribution of electricity to a plurality of temporarily parked electrically powered vehicles comprising a plurality of power outlets, a low-voltage switchgear connected to the power outlets, a transformer connected to the low-voltage switchgear, and a high-voltage switchgear connected to the transformer for connection to a cable-fed power grid, wherein the transformer is located adjacent to the parking surface, the high-voltage switchgear is located adjacent to the power grid, and wherein the high-voltage switchgear is directly connected to the transformer by a high-voltage cable. In one embodiment the high-voltage connection comprises a T-branching with a circuit breaker that is tripped in a shorter time than other circuit breakers in the power grid.

According to a second aspect of the invention, the object is achieved by a method for distribution of power to a plurality of electrically powered vehicles temporarily parked on a parking surface, comprising a plurality of power outlets, a low-voltage switchgear connected to the power outlets, a transformer connected to the low-voltage switchgear, and a high-voltage switchgear connected to the transformer for connection to a cable-fed power grid, wherein the transformer is located adjacent to the parking surface, the high-voltage switchgear is located adjacent to the power grid, and wherein the high-voltage switchgear is directly connected to the transformer by a high-voltage cable.

DESCRIPTION OF THE DRAWINGS

The invention will now be explained in more detail by description of embodiments with reference to the enclosed drawings, wherein

fig 1 is a schematically shown installation for power supply to a plurality of electrically powered vehicles according to the invention,

fig 2 is a high-voltage switchgear for such an installation connected to a distribution network,

fig 3 is a transformer installation according to the invention with the transformer located below ground and connected to a low-voltage switchgear located above ground,

fig 4 is an embodiment of a power supply system with a cable protection device having posts comprising power outlets for connection to an electric car, and

fig 5 is an embodiment of a connection module.

DESCRIPTION OF EMBODIMENTS

The installation according to figure 1 is arranged for an infrastructure such as power supply, measurement, control and payment system for charging of electric and electric hybrid cars when they are parked in a parking lot.

Since the power output from the respective car becomes large and it is desirable that a charging of a battery takes less than 5 - 6 hours, there is usually no possibility to pull low-voltage power supply from the nearest network station. On the one hand, there is usually no capacity, and on the other, the low-voltage cables become long, and thus both expensive and suffer from large losses. According to the invention the

installation is configured such that the electrical pressure point, the transformer, is directly connected to the parking lot.

Power supply is obtained by means of connection of a high-voltage switchgear 1 with a T-branching arranged at a suitable place in an existing cable-fed network station loop. Usually such a connection is at 10 or 24 kV. The connection point is chosen so that a minimal distance is obtained, but also so that a suitable location is obtained where the switchgear can be installed in co-operation with the surrounding environment. The switchgear includes a circuit breaker 3 for opening and closing and a device 4 for tripping of the circuit breaker upon an electrical fault. Special design of the T-branching makes its outer dimensions limited and thus allows it to be erected without a building permit.

The high-voltage switchgear 1 is thus located adjacent to the distribution grid 2 and is directly connected to the transformer 7 by a high-voltage cable 5. By directly connected is to be understood that the high-voltage switchgear is directly connected to the transformer without the need of additional circuit breakers. The high-voltage switchgear 1 includes a circuit breaker 3 which is controlled and powered via a signal cable 16 from the low-voltage switchgear 8 of the transformer.

From a high-voltage switchgear 1, a radially feeding cable 5, which is intended for 10-36 kV, extends to a transformer facility 6, which is advantageously located below the ground and thereby does not steal existing ground surface, and also does not change or interfere with the environment aesthetically. A distribution transformer 7 is placed in a caisson, normally with ratings of 10-36/0.4 kV. The low-voltage side of the transformer flexibly feeds a low-voltage switchgear 8 having a plurality of switches 9 which are arranged in a casing 21. The low-voltage switchgear is thus not mechanically connected to the transformer by a busbar. Instead, the connection constitutes a cable so

that the switchgear can be located arbitrarily in relation to the transformer. The casing can be designed in the same way as the cable cabinets that normally exist today. A ventilation device 10 is connected to the caisson which includes one or more fans for ventilation of the heat losses from the transformer in the transformer caisson.

From the low-voltage switchgear, low-voltage cables 11 extend which supply various rows of outlets 12 placed on posts at a parking surface 13 comprising a number of parking boxes.

The high-voltage switchgear 1 according to figure 2 includes a circuit breaker module 15 which comprises a circuit breaker 3. The module comprises a first measurement and detecting device 4a for tripping of shortcircuit faults. The module also comprises a second measurement and detecting device 4b for tripping of shortcircuit faults and earth faults. The devices are connected to the low-voltage switchgear by a signal cable 16 for power supply and information exchange with the low-voltage switchgear. By means of the signal cable the circuit breaker may be controlled. The signal cable also implies that the circuit breaker and the devices can be supplied with power from the low-voltage side of the transformer. By this current feeding the need for batteries or other local power supply of the circuit breaker is avoided. In one embodiment of the invention the devices comprise a microprocessor and a memory for storing data and software. The high-voltage switchgear is connected to an existing high-voltage cable 2 in a distribution system, which cable from a connection point of view extends straight through the circuit breaker module 15. In the shown example the ingoing cable 2a to the circuit breaker module is connected in a cable connection 17.

According to the invention the building volume of the high-voltage switchgear is concentrated, whereby the building height can be made low. The high-voltage switchgear is enclosed in a casing 14 that may be a plate structure or a composite structure of plate and concrete. By

plate is here intended a sheet of metal as well as of plastic or of a laminate of a number of materials such as metal, plastic, wood or similar. By placing parts of the switchgear below the ground surface 18, a further reduction of the building height is obtained. Those parts of the switchgear that need to be served are positioned behind openable doors 19 in the casing 14. The small size and the possibility to locate the switchgear in a way that does not adversely encroach upon the landscape means that building permit can be avoided.

One embodiment of the transformer installation 6 is shown in figure 3. The transformer module 7 is placed below ground level 18 in a caisson 25 of concrete or equivalent material which can be built on site or prefabricated. The caisson is provided with a cover comprising an inspection hatch 20. In the shown example, the low-voltage switchgear 8 is placed in a casing 21 which is common for the ventilation 10 of the transformer. The switchgear is available through a door 22 and the ventilation through a grid 23. In the shown example, the low-voltage cables 11 are placed below the ground surface 18 in a protective pipe 24.

One embodiment of a power supply system with a plurality of power outlets 12 for connection to a plurality of electric cars is shown in Figure 4. A cable protection device 30 as in the shown example is designed with a crescent-shaped casing of a resistant material. The protection device shall resist, i.a., damage and collision. The cable protection device may consist of several modules 41 which are built together by joints 31 and secured to the ground by outer fastening devices 32. In one embodiment the cable protection device is secured by an inner fastening device 33. The fastening devices can be secured to the ground by screw or nail joints or by glue or an equivalent adhesive. Because the cables are arranged directly on the parking surface and protected by the cable protection device which is secured to the parking surface, digging is avoided which results in a cost saving.

The cable protection modules 41 form, in the shown example, a base for a plurality of posts 35, each one supporting its connection module 36. Each connection module has at least one outlet. In one embodiment the power outlet includes an inner post 45 that is driven down and anchored in the parking surface. In this embodiment the outer post 35 becomes a lining that encloses the inner post and protects the cables pulled between the inner and outer posts. Thus, it is possible to first place all posts, then to pull all the cables and finally to cover all cables with a cable protection device and a lining. In one embodiment the connection module includes at least four outlets. Each post is provided with an adjusting device 37 by which the post is adjustable to a vertical position.

In one embodiment the connection module has two outlets, each one covered by a lockable cover 38. The shown example also comprises a payment and control module 39 by which a customer can pay or be identified through, for example, a credit card or a so-called RFID card or some other similar solution. The payment may also be effected via the Internet, through payment by mobile phone subscriptions, or through interactive card systems. In one embodiment the low-voltage switchgear 8 and the control module are housed in the same casing. The module also includes means for wireless communication by which the power outlets can be controlled or information obtained from, for example, a mobile phone. In the shown example a power outlet includes a reader 40 for a credit card or the like, whereby the payment and control module can be excluded.

The power outlets 12 are designed with one or several outlet fittings and a device for controlling the charging current as well as any supplementary heating in the car. In the shown example the power outlet is dead (without voltage) as long as no plug contact is seated in the outlet, or if the cover is open. This is to prevent fingers from coming into contact with live parts of the outlet. It also prevents uncontrolled

power output and prevents theft of electricity. When the plug contact is plugged into the outlet, the cover is closed and the power supply is activated by the car driver, voltage is connected while at the same time a locking device prevents removal of the plug contact or access to the power outlets. The system is designed so that the locking devices are released at a general power failure.

The car driver activates the charging by using a credit card, an SMS code, a code lock or some other device. This can be effected by a mobile phone or at an activation machine 39. Simultaneously with the activation, measurement is initiated as a basis for invoicing of the common parking and charging service. The measurement, which may consist of time measurement, energy measurement or both, ends in the connection being deactivated by the car driver. Invoicing is effected by billing via the phone bill or the like, or by charging on a credit card. The heating outlet can be activated by means of an SMS and a mobile phone, a clock, or in a similar manner.

A connection module 36 according to one embodiment of the invention is shown in figure 5. Its top side is slightly larger than the bottom side to offer good protection from rain. The module has two outlet units, each covered with a cover 38, one of which is shown in an open position. The cover protects an inner room 51 with space for at least one electric outlet 42. In the shown example the outlet comprises two phases but it may very well also be a three-phase outlet. The cover is pivotely mounted on hinges 47 and has at its opposite side two striker plates 44 for receiving a respective locking bolt in the connection module. According to one embodiment the locking bolts are resilient. When the cover closes these are first moved backwards so as to then enter into the striker plates and lock the cover. The locking bolts are then arranged to be retracted by an electromotive force so that the cover is opened.

According to one embodiment, the locking bolts are moved to a locked position and are retrained in this position by an electromotive force. When the charging is deactivated, the electromotive force is disconnected and the locking device is returned to a non-activated position in which the cover can be opened.

The connection module further includes an LED 50 which indicates if voltage is present. A reader 40 for sensing an identity carrier or an interactive acting card is arranged on the front side of the module. A solar cell 48 for backup operation is arranged on the top side and one or more lighted windows 49 for information or advertising is arranged on the sides of the module. The room inside the cover is arranged to accommodate a plug contact (not shown) that is connected to the outlet 42. When the cover is closed, a slot 46 is arranged to allow passage of a cord attached to the plug contact. The slot is designed so that fingers can not penetrate and reach the outlet, and can be provided with a lip of an elastic material that protects the room from the weather.

Since relatively heavy pressure points are located in existing urban and residential areas, it is advantageous to place the transformer close to the outlets. It is also advantageous to introduce an equipment that takes up little space. This is particularly important where a building permit is required. Therefore, the T-coupling at the connection to a high-voltage cable is not larger than an enlarged cable cabinet. The transformer is placed below ground, while the low-voltage switchgear is housed in a standard cable cabinet. The conditions to obtain a general building permit thus increase significantly. The parking has a lower priority than the rest of the loop in that it is radially fed, but in case of a fault it trips before the loop, both for overcurrent and for directional earth fault. No battery or other auxiliary power is needed. The cables for 10 kV are not dimensioned according to load, but short-term power.

In case of a fault in the transformer, in the feeding distribution station or if an undesirable power peak occurs in the network, the power supply installation can be disconnected from the grid and thus gives priority to another load before the load of the parking. For such circumstances, the installation comprises a battery function that saves the amount of energy taken out for later billing. Upon such disconnection of the installation, all plug contacts are released so that the consumers can use their vehicles for departure.

The invention is not limited to applications within the voltage range of 230 – 500 volts. Thus, the invention also includes applications within the whole low-voltage range, i.e. up to 1000 volts. The invention is also not limited to applications with galvanic contact between the vehicle and the power supply system, but the inventive idea also comprises systems in which the electrical energy is transferred by induction and so on.

CLAIMS

1. An installation for distribution of power to a plurality of temporarily connected power consumers on a parking surface (13) comprising a plurality of power outlets (12), a low-voltage switchgear (8) connected to the power outlets, a transformer (7) connected to the low-voltage switchgear, and a high-voltage switchgear (1) connected to the transformer for connection to a cable-fed power grid (2), **characterised in** that the transformer (7) is located adjacent to the parking surface, that the high-voltage switchgear (1) is located adjacent to the power grid (2), and that the high-voltage switchgear is directly connected to the transformer (7) by a high-voltage cable (5).

2. Installation according to claim 1, wherein the high-voltage switchgear (1) comprises a T-branching including a circuit breaker (3) with a device (4) which is supplied with current via a signal cable (16) from the low-voltage switchgear (8), said circuit breaker being tripped in a shorter time than other circuit breakers in the power grid.

3. Installation according to claim 1 or 2, wherein the high-voltage switchgear (1) is located partly below the ground surface (18).

4. Installation according to any preceding claims, wherein the transformer (7) is situated below the ground surface (18).

5. Installation according to any preceding claims, wherein the installation comprises a caisson (6) which accommodates the transformer (7).

6. Installation according to claim 5, wherein the low-voltage switchgear (8) is placed on top of the caisson.

7. Installation according to any preceding claims, wherein at least one power outlet (12) comprises a connection module (36) supported by a post (35), and connected to the low-voltage switchgear with a power cable (11) arranged directly on ground and protected by a cable protection device (30).

8. Installation according to claim 7, wherein each connection module (36) comprises at least one lockable room (51) comprising at least one power outlet (42), that the room is arranged to accommodate a plug contact connected in the outlet, that the room is restricted by a lockable cover (38), that the cover in locked position encloses the plug contact and forms a slot (46) for receiving a cord connected to the outlet, and that the power supply is activated only when the cover is locked.

9. Method for distribution of power to a plurality of electrically powered vehicles temporarily parked on a parking surface (13), comprising a plurality of power outlets (12), a low-voltage switchgear (8) connected to the power outlets, a transformer (7) connected to the low-voltage switchgear, and a high-voltage switchgear (1) connected to the transformer for connection to a cable-fed power grid (2), **characterised in** that the transformer (7) is located adjacent to the parking surface (13), that the high-voltage switchgear is located adjacent to the power grid, and that the high-voltage switchgear is directly connected to the transformer (7) by a high-voltage cable (5).

10. Use of an installation according to claims 1 to 8, or a method according to claim 9, for charging of batteries for a plurality of electrically powered vehicles at a public or private parking place, wherein a sufficient energy supply is secured.

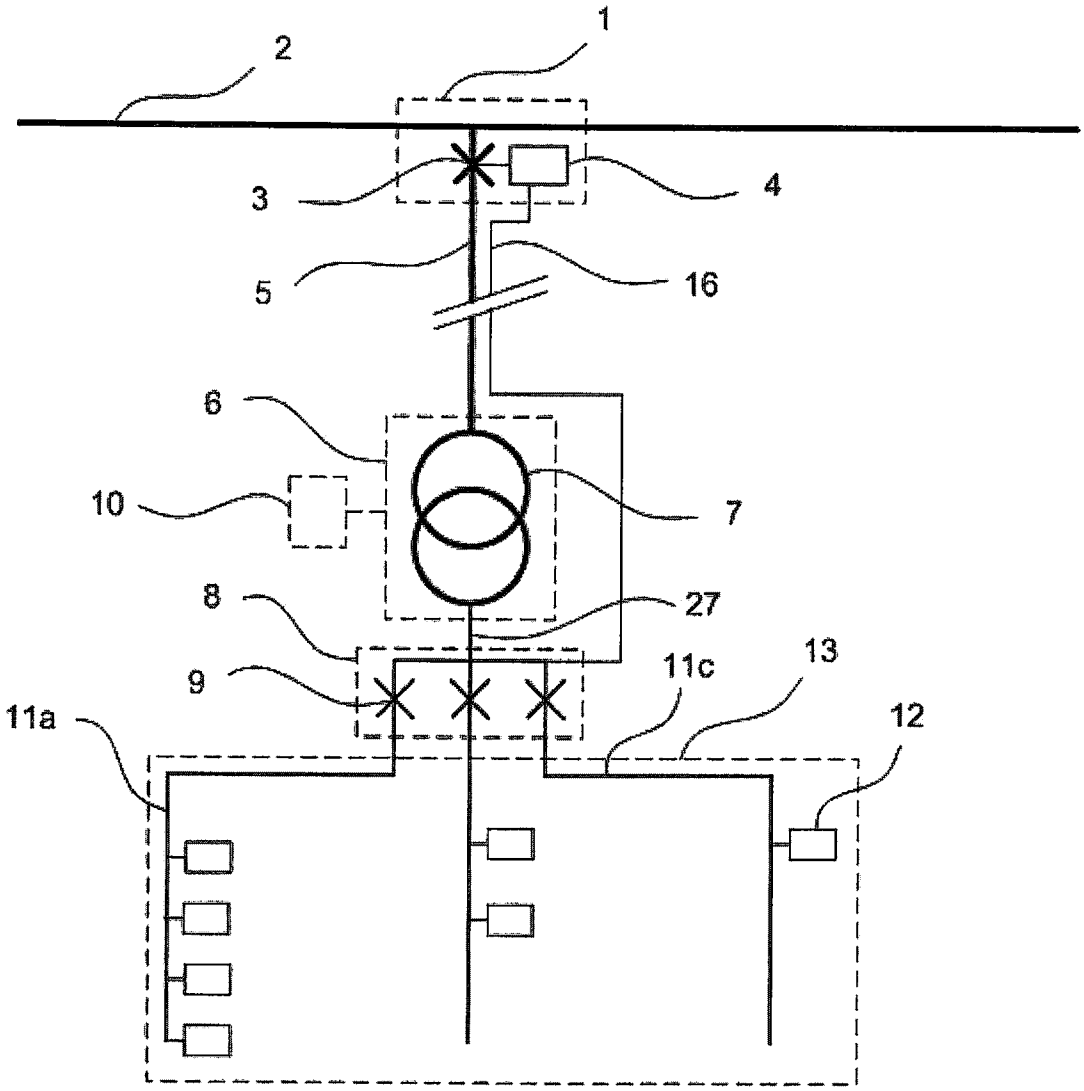

Fig 1

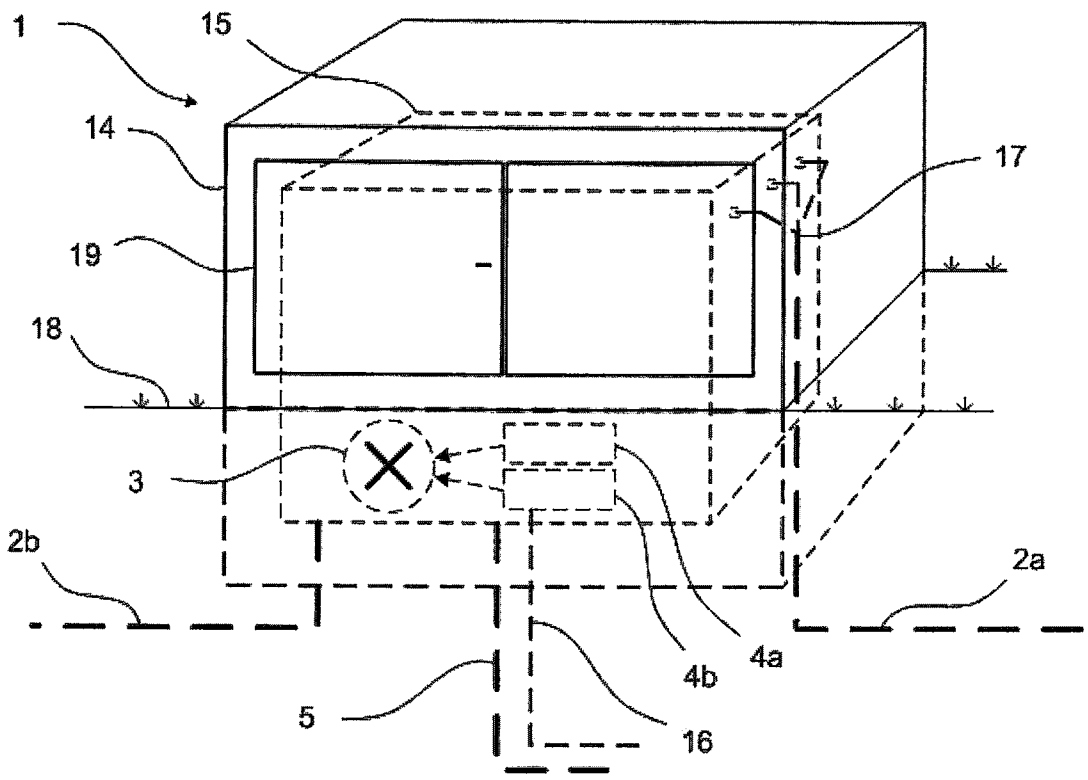

Fig 2

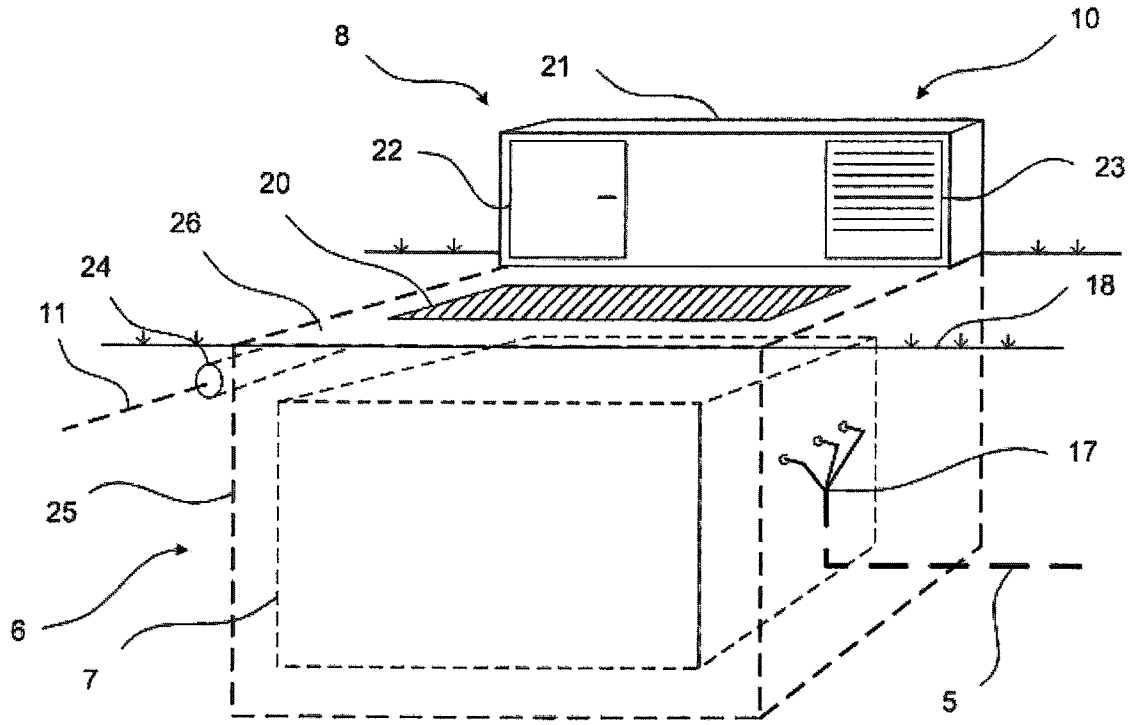

Fig 3

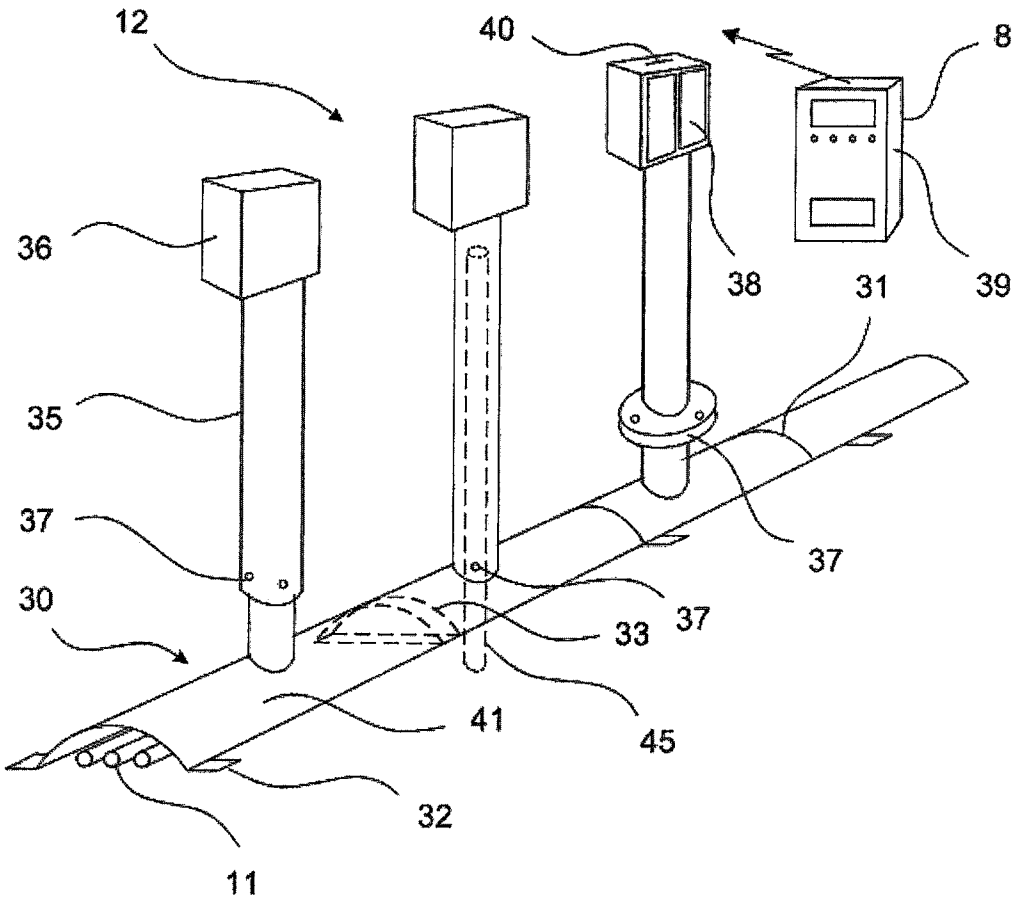

Fig 4

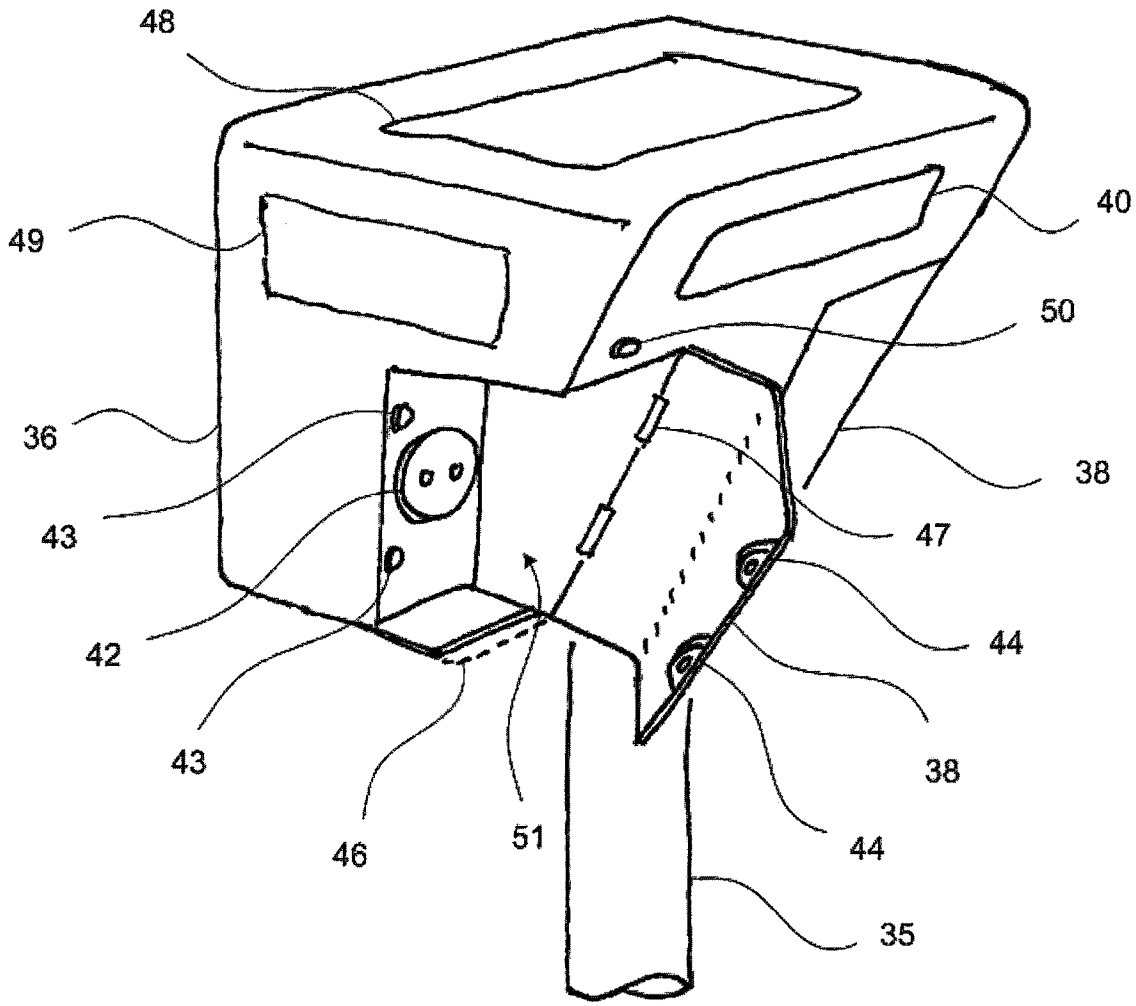

Fig 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/000084

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:B60L, H02B, H02J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6081205 A (WILLIAMS DOUGLAS J [US]), 27 June 2000 (2000-06-27); abstract; column 6, line 25 - column 7, line 35; figures 1,4	1-10
Y	US 2891129 A (AREM FOTI ET AL), 16 June 1959 (1959-06-16); column 1, line 29 - column 1, line 36; column 3, line 40 - column 3, line 49; figure 1	1-10
Y	US 20060181837 A1 (SUN BING ET AL), 17 August 2006 (2006-08-17); abstract; figures 4, 15; [0062]-[0063]	3-6
Y	EP 1764888 A1 (PREFABRICADOS UNIBLOK S A), 21 March 2007 (2007-03-21); whole document	3-6
Y	DE 9307580 U1 (KRANZ REINHARD OTTO DIPL ING D [DE]), 22 September 1994 (1994-09-22); whole document; See especially figures 2-3, detail 13.	7
Y	FR 2766950 A (BORGOLTZ HERVE), 5 February 1999 (1999-02-05); abstract; page 2, line 19 - page 2, line 26; page 4, line 22 - page 5, line 25; figures 1,3; claims 1-10	8

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10-09-2010	14-09-2010

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Ervin Dubaric Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/000084

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

1: Claims 1-6, 9-10 directed to connecting a charging station, for electrical vehicles, to a power grid.

2: Claim 7 directed to power cable installation.

3: Claims 8 directed to preventionen of unauthorised use of a power outlet.

.../...

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Continuation of: Box No. III

The present application has been considered to contain 3 inventions which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

The closest prior art has been identified as: D1 US6081205 A

Document D1 discloses a combined parking meter and recharging station for electric vehicles; see abstract and figure 3. The station comprises a central unit (102), which is connected to a power source and a plurality of meters (130), (132) and (134 where each meter has a connector (142), (144) and (146). The meters are mounted on a parking or a recharge island (150), see column 6 (row 12) – column 6 (row 24). The central unit comprises a processor (148), switches (152) and (158) and a transformer (154); see figure 4 and column 6 (row 25) – column 7 (35).

The invention according to claim 1 differs from the recharging station in D1 in that a high voltage switchgear is located adjacent to the power grid and that the high voltage switchgear is directly connected to the transformer (154), in the recharging station, by a high voltage cable.

A solution to this problem is known from document D2, which describes a connection between a high voltage bus and a low voltage station bus; see figure 1. The high voltage station bus (10) is connected connected to a high voltage circuit breaker (12) which in turn is connected to a transformer (11). The transformer (11) is connected to a low voltage circuit breaker (13) which is connected to a low voltage station bus (14). The high voltage circuit breaker (12) and the transformer are separated by several miles; see column 3 (row 40 – 49).

It is therefore considered to be obvious for a person skilled in the art to use the teachings of D2 together with the prior art as specified in D1 in order to achieve an installation of a charging station according to the claimed invention.
Accordingly, the invention as claimed in claim 1 lacks an inventive step.

Due to these features, the charging station is safely connected to the power grind and with minimised transmission losses.

Invention 1:

From a comparison of the disclosure of D1 and the technical features of claims 1-6, the following technical features can be seen to make a contribution over this prior art:

The charging station is connected to the power grid with a power cable, which is directly connected from the transformer to a high power switch gear. The high power switch gear is located in the proximity of the power grid.

These features are hence considered as special technical features in the sense of Rule 13.2 PCT.

The effect of these features are a safe connection to the power grid.

In view of these special technical features, the objective problem to be solved by the first invention can be construed as being the following:

To provide a method that has the effect of safe connection of a load to a power grid.

Continuation of: Box No. III

Invention 2:

From a comparison of the disclosure of D1 and the technical features of claim 7, the following technical features can be seen to make a contribution over this prior art:

The meters are connected to the central unit cables which are arranged directly on the ground and that the cables are covered by cable protections.

These features are hence considered as special technical features in the sense of Rule 13.2 PCT.

The effects of these features are an easier and safer installation of electric cables.

In view of these special technical features, the objective problem to be solved by the first invention can be construed as being the following:

To provide a method that has the effect of easy and safe cable installation.

Invention 3:

From a comparison of the disclosure of D1 and the technical features of claim 8, the following technical features can be seen to make a contribution over this prior art:

The connectors are enclosed behind a cover in a lockable box.

These features are hence considered as special technical features in the sense of Rule 13.2 PCT.

The effects of these features are protecting the meters from unauthorised use.

In view of these special technical features, the objective problem to be solved by the first invention can be construed as being the following:

To provide a method that has the effect of prevention from unauthorised use of a power outlet.

The above analysis shows that the special technical features of invention 1 (claims 1-6) are neither the same as, nor correspond to, those of invention 2 (claim 7) or invention 3 (claim 8).

This appears to show a lack of corresponding technical effect as well. Consequently, neither the objective problem underlying the subject matter of the (two-N) claimed inventions, nor their solutions defined by the special technical features, allow for a relationship to be established between the said inventions, which involves a single general inventive concept.

Therefore, in conclusion, the 3 groups of claims are not linked by the same or corresponding special technical features and define different inventions not linked by a single general inventive concept.

Hence, the application does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/000084

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20090062967 A1 (CONS EDISON COMPANY OF NEW YOR [US]), 5 March 2009 (2009-03-05); figure 1; [0026]-[0029]	1-10
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A	WO 9601520 A1 (VATTENFALL AB ET AL), 18 January 1996 (1996-01-18); whole document	1-10
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A	US 5847537 A (PARMLEY SR DANIEL W), 8 December 1998 (1998-12-08); column 4, line 1 - column 4, line 21; figures 1, 8	1, 3-6
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A	US 5583418 A (HONDA SATOSHI ET AL), 10 December 1996 (1996-12-10); column 22, line 30 - column 23, line 22; figures 24-29	1-10
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A	US 3027439 A (UPTON JR CHESTER W ET AL), 27 March 1962 (1962-03-27); figure 2	1, 11
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International application No.
PCT/SE2010/000084

Continuation of: second sheet

International Patent Classification (IPC)

B60L 11/18 (2006.01)
H02B 7/08 (2006.01)
H02J 7/00 (2006.01)

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Use the application number as username. The password is **UEOUILQPCY**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

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US	2891129	A	16/06/1959	NONE			
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