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(54) **Title:** METHOD FOR CONNECTING A VOLTAGE SOURCE

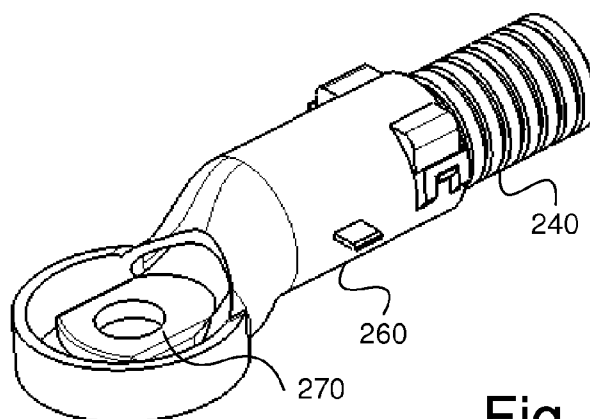


Fig. 3i

(57) **Abstract:** The invention relates to a method for connecting a voltage source (289), comprising the step of providing said voltage source (289) and at least two electrically connected cables (230, 240, 250) which are powered by the voltage source and each have a free end with a connecting lug (270). The method comprises also the step of fitting (s401; s410) an electrically insulating protection unit (260) close to at least one of said connecting lugs (270), which protection unit (260) prevents external electrical contact with said at least one connecting lug (270) but allows said at least one connecting lug (270) to be electrically connectable. The invention relates also to a protection unit (260), a voltage source configuration (299) and a motor vehicle (100; 110) which is equipped with the voltage source configuration (299).



Method for connecting a voltage source

TECHNICAL FIELD

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The present invention relates to a method for connecting a voltage source. The invention relates also to a protection unit for a cable intended to be electrically connected to and powered by a voltage source. The invention also relates to a voltage source configuration and vehicle equipped with the voltage source configuration.

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BACKGROUND

In the manufacture of vehicles, e.g. heavy motor vehicles such as trucks or buses, it is very important that fitters and other personnel should come to no harm. It is also very important that vehicle components should not be damaged during transport and handling before and during fitting.

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In this context it is desirable to constantly try to improve processes and routines for achieving efficient and safe fitting of components during vehicle manufacture. It is constantly desirable to shorten lead times during the manufacture of vehicles and that processes be continuously improved.

20

When installing battery packages, e.g. vehicle batteries, the battery package may be fitted first, followed by applying electric cables for power supply by means of connecting devices to desired power consumers. Thereafter the cables are connected to the battery unit. The result is a fitting procedure which is rather safe for the fitter and involves minimum risk of short-circuiting the battery package. However, this procedure is time-consuming in comprising a number of fitting steps which entail safety-enhancing measures.

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In an alternative procedure for installing battery packages, e.g. vehicle batteries, electric cables for power supply may be initially applied by means of connection devices to desired power consumers, followed by fitting the battery package. Thereafter electric cables are connected to the battery unit.

- 5 The result is an alternative fitting procedure which is rather safe and involves minimum risk of short-circuiting the battery package. However, this procedure is likewise time-consuming in comprising a number of fitting steps which entail safety-enhancing measures.
- 10 US 5,346,408 describes a battery cable unit comprising a battery cable which has a conductive core and an insulating envelope and a metal cable terminal which comprises an element which is substantially flat in one plane and a crimping element for fastening the terminal to the battery cable.
- 15 US 4,050,757 describes an insulating sleeve for electrical terminals which has a symmetrical cross-section so that it can be fitted in two different positions.

SUMMARY OF THE INVENTION

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There is thus a need to achieve a safe and robust method for installing a battery package in a vehicle, which method makes shortened lead times possible.

- 25 One object of the present invention is to propose a novel and advantageous method for connecting a battery unit to a power consumer on board a vehicle.

- Another object of the invention is to propose a novel and advantageous
30 battery configuration which allows safe handling of a battery configuration for a vehicle.

Another object of the present invention is to propose a novel and advantageous battery configuration which allows safe fitting of same.

A further object of the present invention is to propose an alternative method
5 for fitting a battery configuration to a vehicle.

These objects are achieved with a method for connecting a battery unit according to claim 1. They are also achieved with a protection unit according to claim 6.

10

One aspect of the invention is a proposed method for connecting a voltage source, comprising the steps of

- providing said voltage source and at least two electrically connected cables which are powered by the voltage source and each have a free end with a
15 connecting lug, and
- fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.

20

One aspect of the invention is a proposed method for connecting a voltage source, comprising the steps of

- providing said voltage source and at least two electrically connected cables which are energised by the voltage source and each have a free end with a
25 connecting lug, and
- fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.

30

Said voltage source may comprise for example one or more battery units electrically connected via a connection box to said at least one protection unit and said at least one connecting lug.

- 5 One aspect of the invention is a proposed method for connecting a battery unit, comprising the steps of
- providing said voltage source and at least two electrically connected cables which are powered by the battery unit and which each have a free end with a connecting lug, and
- 10 - fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.
- 15 One aspect of the invention is a proposed method for connecting a battery unit, comprising the steps of
- providing said voltage source and at least two electrically connected cables which are energised by the battery unit and which each have a free end with a connecting lug, and
- 20 - fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.
- 25 The result is a safe method for connecting a battery unit to a connection configuration intended for the purpose, e.g. on board a vehicle. Using said protection unit to protect the connecting lug reduces or eliminates the risk of short-circuiting the battery unit, e.g. during transport of same before final fitting.
- 30 The protection unit is configured in such a way as to also allow time-efficient final fitting of the battery unit to said connection configuration. The need to

handle detachable protective devices for the connecting lugs, e.g. rubber sleeves, is thus eliminated. This is desirable not least from an environmental perspective in that unnecessary use of disposable articles is avoided. It is also desirable from a user perspective in that a fitter does not have to

5 perform the step of detaching said protective devices when connecting the battery unit to said connection configuration.

In the context of the method, said connecting lug may be a ring lug. The result is a user-friendly method in that ring lugs are easy to apply to a contact

10 of a power consumer on board the vehicle. A ring lug can easily and flexibly be connected to purpose-made means for creating electrically conductive contact between the battery unit and said power consumer. This makes it possible to create said contact by means of a standard tool, thereby eliminating extra costs pertaining to special tools. Said ring lug may be

15 fastened by means of suitable threaded connections. Said connecting lug may be fastened by means of suitable threaded connections.

In the context of the method, said protection unit may be fastened to said cable by means of a fastening portion, resulting in robust application of the

20 protection unit round a cable of the battery unit. The fastening portion may be configured to sealingly accommodate said cable, thereby counteracting relative sliding movements between the protection unit and the cable.

In the context of the method, said fastening portion may comprise two

25 coordinated halves which lock together round said cable. The protection unit may thus be applied to said cable in a user-friendly way. An operator therefore need only place the cable in one half of the fastening portion and turn the other half of the fastening portion across to lock the two halves round the cable in a desirable way.

30

The method may further comprise the step of

- providing said protection unit with a substantially cylindrical portion which is connected to said fastening portion and adapted to running round said connecting lug.

- The result is a method according to one aspect of the invention which
- 5 reduces the risk of short-circuiting the battery unit while at the same time achieving easy and quick connection of the battery unit to a power consumer. Said cylindrical portion is adapted to mechanically preventing contact with the surroundings, e.g. other connecting lugs of cables of the battery configuration or electrically conductive objects. Providing said protection unit with a
- 10 protective portion which is tubular results in good potential for connecting the cable's connecting lug to means intended for the purpose. Said means may for example take the form of a studbolt, in which case a fitter draws the connecting lug over the studbolt and uses a nut to fasten the connecting lug.
- 15 Said protective portion may be of any suitable configuration and is therefore not restricted to being cylindrical. It may provide the connecting lug with any suitable degree of cover which achieves suitable protection against contact with the surroundings as well as easy connection to a connection configuration intended for the purpose. Easy connection here means for
- 20 example easy use of tools for said connection.

- One aspect of the invention is a proposed protection unit for a cable which is adapted to being electrically connected to and powered by a battery unit and which at a free end has a connecting lug. The protection unit is adapted to
- 25 preventing external electrical contact with said connecting lug but allowing said connecting lug to be electrically connectable. Said connecting lug may be a ring lug. The protection unit may further comprise a substantially cylindrical portion adapted to running round said connecting lug. The protection unit may further comprise a fastening portion adapted to being
- 30 attached to the free end of said cable. Said fastening portion may comprise two coordinated halves which lock together round said cable.

Said protection unit may be arranged for two cables and connecting lugs, making it possible in a time-efficient way to connect two power cables to a given connection configuration, e.g. comprising two studbolts arranged in a predetermined way. It is thus possible for the two respective connecting lugs
5 to be applied substantially simultaneously to said studbolts, followed by nuts being screwed on to secure the connection. The protection unit may be configured in a suitable way appropriate to the vehicle's prevailing connection configuration.

10 With advantage, the possibility of providing cables for different voltage levels is also achieved, which is desirable with a view to the present invention being versatile.

Said protection unit may take the form of a single part, making it easy for an
15 operator to handle and also easy and relatively inexpensive to manufacture.

One aspect of the invention is a proposed battery configuration comprising a battery unit and at least two cables which are connected to and powered by the battery unit and each have a free end with a connecting lug, at least one
20 of said connecting lugs being provided with a protection unit as herein described. The result is a battery configuration for a vehicle which can be preassembled in such a way as to potentially shorten lead times during final fitting. Providing said battery configuration with a suitable number of protection units according to the invention makes it possible for a fitter to
25 safely and efficiently fit said battery configuration to the vehicle by directly applying the connecting devices protected by the protection unit to connection configurations intended for the purpose.

One aspect of the invention is a proposed voltage source configuration
30 comprising a voltage source and at least two cables which are connected to and powered by the voltage source and each have a free end with a connecting lug, at least one of said connecting lugs being provided with a

- protection unit as herein described. The result is a voltage source configuration for a vehicle which can be preassembled in such a way as to potentially shorten lead times during final fitting. Providing said voltage source configuration with a suitable number of protection units according to
- 5 the invention makes it possible for a fitter to safely and efficiently fit said voltage source configuration to the vehicle by directly applying the connecting devices protected by the protection unit to connection configurations intended for the purpose.
- 10 One aspect of the invention is a proposed vehicle provided with a battery configuration. The vehicle may be any from among, truck, bus or car.

Further objects, advantages and novel features of the present invention will become apparent to one skilled in the art from the following details, and also

15 by putting the invention into practice. Whereas the invention is described below, it should be noted that it is not confined to the specific details described. One skilled in the art having access to the teachings herein will recognise further applications, modifications and incorporations within other fields, which are within the scope of the invention.

20

BRIEF DESCRIPTION OF THE DRAWINGS

For fuller understanding of the present invention and its further objects and advantages, the detailed description set out below should be read in

25 conjunction with the accompanying drawings, in which the same reference notations are used for similar items in the various diagrams,

Figure 1 schematically illustrates a vehicle according to an embodiment of the invention,

- 30 Figure 2 schematically illustrates a battery configuration according to an embodiment of the invention,

Figures 3a-3d schematically illustrate a protection unit according to an aspect of the present invention,

Figures 3e-3h schematically illustrate a protection unit according to an aspect of the present invention,

5 Figure 3i schematically illustrates a protection unit according to an aspect of the present invention,

Figure 3j schematically illustrates a protection unit according to an aspect of the present invention,

10 Figure 4a is a schematic flowchart of a method according to an embodiment of the invention, and

Figure 4b is a more detailed schematic flowchart of a method according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

15

Figure 1 depicts a side view of a vehicle 100. The vehicle may be a motor vehicle comprising a combustion engine and a battery configuration 299. The vehicle may be a hybrid vehicle comprising a combustion engine, electric motor, energy store and a battery configuration 299. It may be an electric
20 vehicle comprising an electric motor, an energy store and a battery configuration 299. The vehicle here exemplified comprises a tractor unit 110 and a trailer 112. It may be a heavy vehicle, e.g. a truck or a bus. It may alternatively be a car. Said battery configuration 299 is described in more detail with reference to the vehicle 2.

25

The vehicle 100 may be any suitable vehicle. It may for example be a tractor, wheel-mounted loader or industrial truck. It may be a belt-driven vehicle, e.g. a tracked vehicle or military tank.

30 Said vehicle 100 may alternatively be a watercraft, e.g. a boat, ferry, ship, steamer or submarine.

It may alternatively be an aircraft, e.g. an aeroplane or helicopter.

Figure 2 illustrates the battery configuration 299, which may be installed on board the vehicle 100, as depicted in Figure 1.

5

The battery configuration comprises a battery unit 289 which may itself comprise any suitable number of batteries. Said batteries may be arranged in suitable ways. They may be suitably connected in parallel and/or in series. In one example the battery unit 289 comprises a first battery 210 and a
10 second battery 220. Said first battery may be a 12 volt battery. Said second battery may be a 12 volt battery. Said first battery and said second battery in one example are connected in series and thereby adapted to providing a first output 241 of 12 volts DC and a second output 251 of 24 volts DC. The battery unit is also provided with an input 231.

15

It should be noted that the battery unit 289 may be provided with any desired number of batteries with mutually similar or different voltage levels, e.g. 5, 10, 12, 24, 36, 50 or 100 volts.

20 A first cable 240 is connected to the battery unit's first output 241 and thereby adapted to providing an output voltage of 12 volts. The first cable has a first end firmly connected to the first output 241. A free second end of the first cable is provided with a connecting lug 270. Said connecting lug may be a ring lug. Said connecting lug may also be called a connecting element. The
25 free end of the first cable is provided with an electrically insulating protection unit 260 which is close to said connecting lug 270 and which prevents external electrical contact with said connecting lug but allows said connecting lug to be electrically connectable to, for example, a connection configuration (not depicted) of the vehicle 100.

30

A second cable 250 is connected to the battery unit's second output 251 and thereby adapted to providing an output voltage of 24 volts. The second cable

has a first end firmly connected to the second output 251. A free second end of the second cable is provided with a connecting lug 270. The free second end of the second cable is provided with an electrically insulating protection unit 260 which is close to said connecting lug 270 and which prevents external electrical contact with said connecting lug but allows said connecting
5 lug to be electrically connectable to, for example, a connection configuration (not depicted) of the vehicle 100.

A third cable 230 is connected to the battery unit. Said third cable is a so-called minus cable adapted to leading back current supplied to one or more
10 consumption units of the vehicle 100 via the first cable 240 and/or the second cable 250. The third cable has a first end firmly connected to the inlet 231 of the battery unit 289. A free second end of the third cable is provided with a connecting lug 270. The free end of the third cable is provided with an
15 electrically insulating protection unit 260 which is close to said connecting lug 270 and which prevents external electrical contact with said connecting lug but allows said connecting lug to be electrically connectable.

It should be noted that the battery configuration 299 may comprise any
20 suitable number of cables which may be connected to it in desirable suitable ways. This may involve providing a suitable number of cables with suitable individual voltage settings.

The term cable is herein used to mean a line adapted to carrying current from
25 the battery unit 289 to a consumption unit on board the vehicle 100. Cables herein described may alternatively be called line means, lines, line units etc. In one example said cables are electrically insulated conductors. The cables of the battery configuration 299 may be of any suitable size in length and cross-section.

30

In one example the first cable 240 is between 0.5 and 1.5 metres long, e.g. 1.0 metre long. In one example the second cable 250 is between 0.5 and

1.5 metres long, e.g. 1.0 metre long. In one example the third cable 230 is between 0.5 and 1.5 metres long, e.g. 1.0 metre long.

Figure 3a is a schematic perspective view of a protection unit 260, here
5 illustrated schematically in a locked state. Figures 3a-3d depict a protection unit 260 in a first embodiment in which it is adapted to being connected to a free end of a cable of the battery configuration 299. The protection unit is thus adapted to protecting an individual connecting lug 270 of a cable against coming into contact with, for example, other connecting lugs of other cables
10 of the battery configuration, thus effectively making it possible to avoid short-circuiting the battery unit 289.

Said protection unit 260 is adapted to being fitted close to a connecting lug 270 (see Fig. 2 and Fig. 3i) of a cable of the battery configuration 299. The
15 protection unit is adapted to preventing external electrical contact with said at least one connecting lug 270 but to allowing said at least one connecting lug to be electrically connectable. Said connecting lug may be adapted to being put into electrical contact with an external power consumer. Said power consumer may comprise a number of different electronic systems and/or
20 power-consuming subsystems of the vehicle 100, e.g. a control system and an air conditioning installation of the vehicle.

In one embodiment example the protection unit 260 is adapted to electrically insulating a ring lug situated at a free end of a cable of the battery
25 configuration 299. The protection unit is adapted to protecting a ring lug situated at a free end of a cable of the battery configuration against contact with objects or persons in the vicinity.

The protection unit 260 comprises a fastening portion 310 adapted to being
30 attached to a free end of any of said cables of the battery configuration 299.

The protection unit 260 comprises also a protective portion 320 which may comprise a substantially cylindrical portion adapted to running round a connecting lug 270 of any of the cables of the battery configuration 299.

- 5 Said protection unit 260 in this embodiment example takes the form of a single part. In an alternative version it may take the form of two or more parts adapted to being suitably fastened to one another for application round a free end of a cable of the battery configuration 299 and thereby serving as protection for said cable's connecting lug.

10

Said protection unit 260 is preferably made of electrically insulating material, which may be a suitable plastic. Said material may comprise a number of different components, e.g. different plastics and/or glass.

- 15 Figure 3b is a schematic cross-sectional view of the protection unit 260, here schematically illustrated in a locked state. It shows the protective portion 320 in this embodiment comprising a cylinder with a substantially circular cross-section. Said cylinder has an inside radius $R1$ and an outside radius $R2$ which may be of suitable dimensions.

20

In a first example, said inside radius $R1$ is 5 mm and said outside radius $R2$ is 7 mm. In a second example said inside radius $R1$ is 10 mm and said outside radius $R2$ is 12 mm. In a third example said inside radius $R1$ is 18 mm and said outside radius $R2$ is 24 mm.

25

The protection unit 260 is equipped in this embodiment with a first locking mechanism 351 and a second locking mechanism 352 which are described in more detail with for example reference to Figure 3d.

- 30 Figure 3c illustrates the protection unit 260 schematically in an open state. Said fastening portion 310 comprises two coordinated halves which can be locked together round a cable of the battery configuration. Said fastening

portion comprises a first half 310a and a second half 310b which are connected together by a fastening element 370. In one embodiment any suitable number of fastening elements 370 may be provided to connect together said first half and said second half. The protection unit 260 may in
5 one example comprise two or three fastening elements situated adjacent to the fastening element illustrated. The result is a function for connecting together said first half and said second half as well as a possibility of turning said second half across to lock together with said first half in order to retain a cable of the battery configuration in a desirable way.

10

In one version said first half 310a and said second half 310b may be separate parts of the protection unit 260, in which case said fastening element 370 is not provided. In this version suitable locking means are provided to lock together said first half and said second half.

15

In the open state depicted it is easy for a fitter to apply the protection unit 260 to a free end of a cable of the battery configuration by following a sequence which comprises the steps of

- 20
- 1) applying the cable in such a way that its connecting lug 270 is positioned in a desirable way within the protective portion 320 and the cable runs in the first half 310a of the fastening portion 310;
 - 2) turning the second half 310b of the fastening portion across so that the cable is sealingly accommodated in the fastening portion,
25 which thus surrounds said cable;
 - 3) locking the two halves (310a, 310b) of the fastening portion in the existing configuration by means of a locking mechanism 351, 352 so that the protection unit 260 is locked firmly round the cable and the connecting lug 270 in a desirable way.

30

Figure 3d illustrates the protection unit 260 schematically in an open state, showing the fastening portion 310 having on a first half 310a a first locking

mechanism 351a and a second locking mechanism 352a, which in this example are female contact elements.

5 The fastening portion 310 illustrated has on a second half 310b a third locking mechanism 351b and a fourth locking mechanism 352b which in this example are male contact elements.

10 Said first locking mechanism 351a is adapted to accommodating said third locking mechanism 351b and thereby performing a locking function. Said first locking mechanism and said third locking mechanism thus together constitute first locking means to temporarily or permanently lock said first half 310a to said second half 310b.

15 Said second locking mechanism 352a is adapted to accommodating said fourth locking mechanism 352b and thereby performing a locking function. Said second locking mechanism and said fourth locking mechanism thus together constitute second locking means to temporarily or permanently lock said first half 310a to said second half 310b.

20 Figure 3e is a schematic perspective view of a protection unit 260. Figures 3e-3h illustrate a protection unit 260 in a second embodiment in which it is adapted to being connected to respective free ends of two cables of the battery configuration. In one example said two cables may be adapted to carrying 12 volts and 24 volts respectively.

25

The protection unit 260 is here adapted to protecting two different connecting lugs 270 against coming into contact with one or more other connecting lugs of the battery configuration, making it possible to avoid short-circuiting the battery unit 289. The protection unit is also adapted to preventing the two
30 connecting lugs 270 from coming into contact with one another during handling of the battery configuration before and during its fitting to the vehicle 100. The protection unit is also adapted to preventing the two connecting

lugs 270 from coming into contact with any electrically conductive objects before and during its fitting to the vehicle.

Said protection unit 260 is arranged for two cables and connecting lugs.

5

Figure 3f is a schematic cross-sectional view of the protection unit 260, illustrating it schematically in a locked state. It shows how the protection unit in this embodiment comprises two cylinders with a substantially circular cross-section. Said cylinders may in one version be formed integrally and thus have a small common region between them.

10

A first cylinder may have an inside radius $R1$ and an outside radius $R2$ as described above with reference to Figure 3b. Said inside radius and said outside radius may be of suitable dimensions.

15

A second cylinder may have an inside radius $R3$ and an outside radius $R4$ which may be of suitable dimensions.

20

In a first example, said inside radius $R3$ is 4 mm and said outside radius $R4$ is 6 mm. In a second example said inside radius $R3$ is 10 mm and said outside radius $R4$ is 12 mm. In a third example said inside radius $R3$ is 18 mm and said outside radius $R4$ is 24 mm.

25

The two fastening portions 310 of the protection unit 260 in this embodiment are each equipped with a first locking mechanism 251 and a second locking mechanism 252 which are described in more detail with for example reference to Figure 3h.

30

Figure 3g illustrates the protection unit 260 schematically in an open state. The two fastening portions 310 here each comprise two coordinated halves which can be locked together round a respective cable of the battery configuration. Said two fastening portions each comprise a first half 310a

and a second half 310b which are connected together by a fastening element 370. In one embodiment any suitable number of fastening elements may be provided to connect together said first half and said second half. The protection unit may in one example comprise a total of three or four fastening elements which may be arranged in suitable ways. The result is a function for connecting together said first half and said second half as well as a possibility of turning said second half across to lock together with said first half in order to retain a cable of the battery configuration in a desirable way.

10 In one version said first half 310a and said second half 310b may be separate parts of the protection unit 260, in which case said fastening elements 370 are not provided. In this version suitable locking means are provided to lock together said first half and said second half.

15 In the open state depicted it is easy for a fitter to apply the protection unit 260 to a respective free end of two cables of the battery configuration by following a sequence which comprises the steps of

- 20 1) applying a first cable in such a way that its connecting lug is positioned in a desirable way within the protective portion 320 and the cable runs in the first half 310a of the fastening portion 310;
- 2) turning the second half 310b of the fastening portion across so that the first cable is sealingly accommodated in the fastening portion, which thus surrounds said first cable;
- 25 3) locking the two halves (310a, 310b) of the fastening portion in the existing configuration by means of a locking mechanism 351, 352 so that the protection unit 260 is locked firmly round the cable and the connecting lug in a desirable way;
- 4) repeating steps 1-3 for a second cable of the battery configuration.

30

Figure 3h illustrates the protection unit 260 schematically in an open state, showing the fastening portion 310 having on a first half 310a a first locking

mechanism 351a and a second locking mechanism 352a, which in this example are female contact elements.

5 The fastening portion 310 illustrated has on a second half 310b a third locking mechanism 351b and a fourth locking mechanism 352b which in this example are male contact elements.

10 Said first locking mechanism 351a is adapted to accommodating said third locking mechanism 351b and thereby performing a locking function. Said first locking mechanism and said third locking mechanism thus together constitute first locking means to temporarily or permanently lock said first half 310a to said second half 310b.

15 Said second locking mechanism 352a is adapted to accommodating said fourth locking mechanism 352b and thereby performing a locking function. Said second locking mechanism and said fourth locking mechanism thus together constitute second locking means to temporarily or permanently lock said first half 310a to said second half 310b.

20 It may be seen in Figure 3h that the protection unit in this embodiment example comprises two fastening portions 310, each for a respective cable of the battery and each provided with substantially similar first locking means and second locking means.

25 Figure 3i illustrates schematically an example of a version in which a protection unit 260 is applied to a connecting lug 270 of the first cable 240.

30 Figure 3j illustrates schematically an example of a version in which respective protection units 260 are applied to connecting lugs 270 of the first cable 240 and the second cable 250.

Figure 4a is a schematic flowchart of a method for connecting a battery unit, according to an embodiment of the invention. The method comprises a first step s401 comprising the steps of

- providing said voltage source and at least two electrically connected cables which are powered by the voltage source and each have a free end with a connecting lug, and
- fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.

In an alternative method for connecting a voltage source said first step s401 comprises the steps of

- providing said voltage source and at least two electrically connected cables which are powered by the voltage source and each have a free end with a connecting lug, and
- fitting close to at least one of said connecting lugs an electrically insulating protection unit which prevents external electrical contact with said at least one connecting lug but allows said at least one connecting lug to be electrically connectable.

The method ends after step s401.

Figure 4b is a schematic flowchart of a method for connecting a battery unit, according to an embodiment of the invention.

The method comprises a first step s410 comprising the step of fitting close to at least one of said connecting lugs 270 an electrically insulating protection unit 260 which prevents external electrical contact with said at least one connecting lug 270 but allows said at least one connecting lug to be electrically connectable. The protection unit may be in one example be fitted

manually. Alternatively it may be fitted by means of an industrial robot. Step s410 is followed by a step s420.

5 Method step s420 comprises the step of electrically connecting electrically to a battery unit 289 at least two cables which each have a free end with a connecting lug 270, at least one of said at least one protection unit 260 being applied to a connecting lug 270. A battery configuration 299 may thus be preassembled. Step s420 is followed by a step s430.

10 Method step s430 comprises the step of electrically connecting said at least two cables to an external power consumer. This may be done in a time-efficient way without removing the protection unit 260 from the cable to which it is applied. The method ends after step s430.

15 The foregoing description of the preferred embodiments of the present invention is provided for illustrative and descriptive purposes. It is not intended to be exhaustive, nor to restrict the invention to the variants described. Many modifications and variations will obviously suggest themselves to one skilled in the art. The embodiments have been chosen
20 and described in order best to explain the principles of the invention and their practical applications and thus make it possible for one skilled in the art to understand the invention for different embodiments and with the various modifications appropriate to the intended use.

CLAIMS

1. A method for connecting a voltage source (289), comprising the step of
- providing said voltage source (289) and at least two electrically connected
5 cables (230, 240, 250) which are powered by the voltage source and each
have a free end with a connecting lug (270),
characterised by the step of
- fitting (s401; s410) an electrically insulating protection unit (260) close to at
least one of said connecting lugs (270), which protection unit (260) prevents
10 external electrical contact with said at least one connecting lug (270) but
allows said at least one connecting lug (270) to be electrically connectable.
2. A method according to claim 1, in which said connecting lug (270) is a ring
lug.
15
3. A method according to claim 1 or 2, in which said protection unit (260) is
fastened to said cable by means of a fastening portion (310).
4. A method according to claim 3, in which said fastening portion (310)
20 comprises two coordinated halves (310a, 310b) which lock together about
said cable.
5. A method according to claim 3 or 4, further comprising the step of
- providing said protection unit (260) with a protective portion (320) which is
25 connected to said fastening portion (310) and is adapted to running round
said connecting lug (270).
6. A protection unit (260) for a cable (230; 240; 250) adapted to being
electrically connected to and powered by a voltage source (289), which cable
30 (230; 240; 250) has at a free end a connecting lug (270),
characterised in that

- the protection unit (260) is adapted to preventing external electrical contact with said connecting lug (270) but to allowing said connecting lug (270) to be electrically connectable.

5 7. A protection unit (260) according to claim 6, in which said connecting lug (270) is a ring lug.

8. A protection unit (260) according to claim 6 or 7, further comprising a protective portion (320) adapted to running round said connecting lug (270).

10

9. A protection unit (260) according to any one of claims 6-8, further comprising a fastening portion (310) adapted to being applied to the free end of said cable.

15 10. A protection unit (260) according to any one of claims 6-9, in which said fastening portion (310) comprises two coordinated halves (310a, 310b) which lock together about said cable.

20 11. A protection unit (260) according to any one of claims 6-10, arranged for two cables and connecting lugs.

12. A protection unit (260) according to any one of claims 6-11, in the form of a single part.

25 13. A voltage source configuration (299) comprising a voltage source (289) and at least two cables (230; 240; 250) which are connected to and powered by the voltage source and each have a free end with a connecting lug (270),
characterised in that
at least one of said connecting lugs (270) is provided with a protection unit
30 (260) according to any one of claims 6-12.

14. A vehicle (100; 110) provided with a voltage source configuration (299) according to claim 13.

15. A vehicle (100; 110) according to claim 14, which the vehicle is any from
5 among truck, bus or car.

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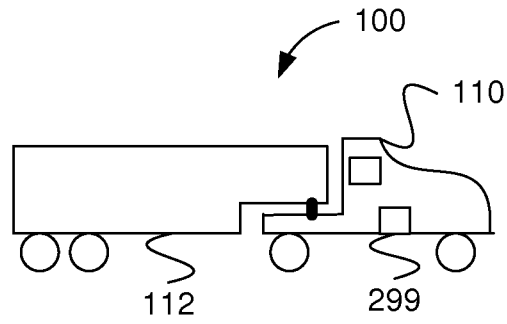


Fig. 1

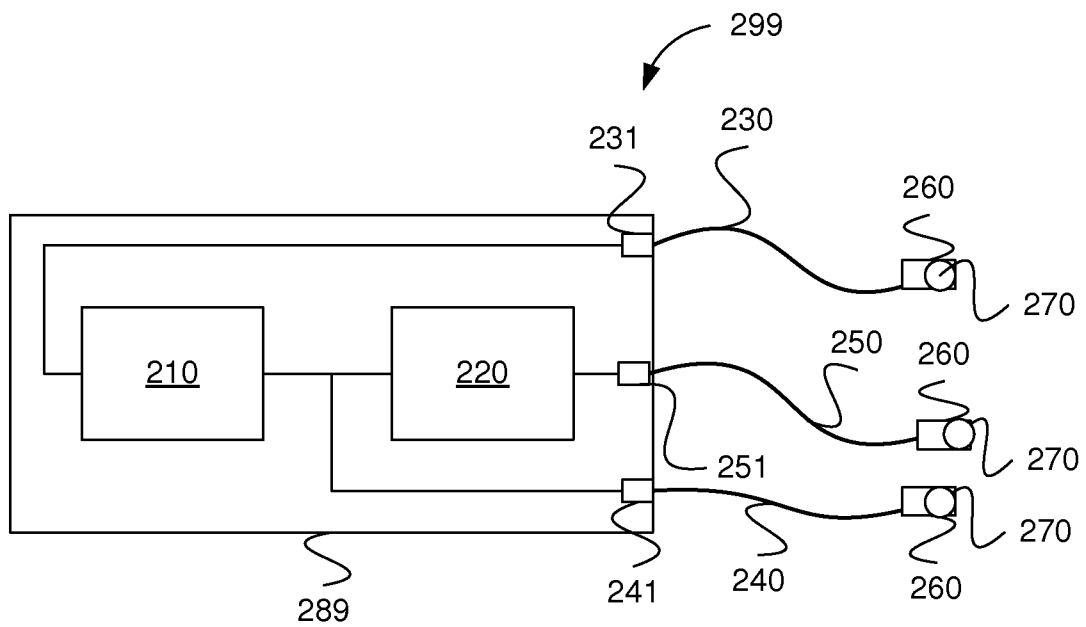


Fig. 2

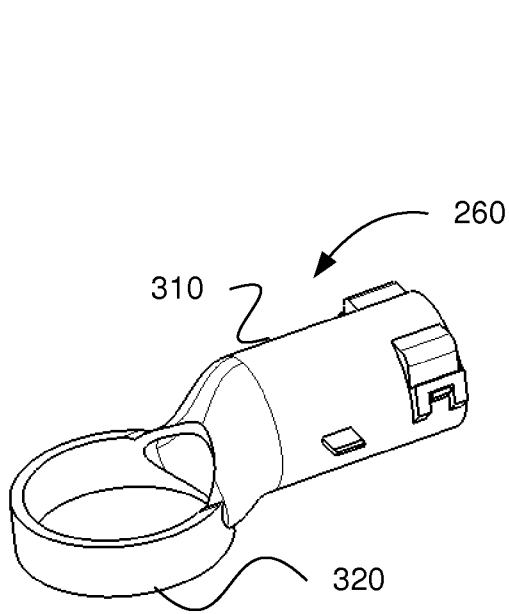


Fig. 3a

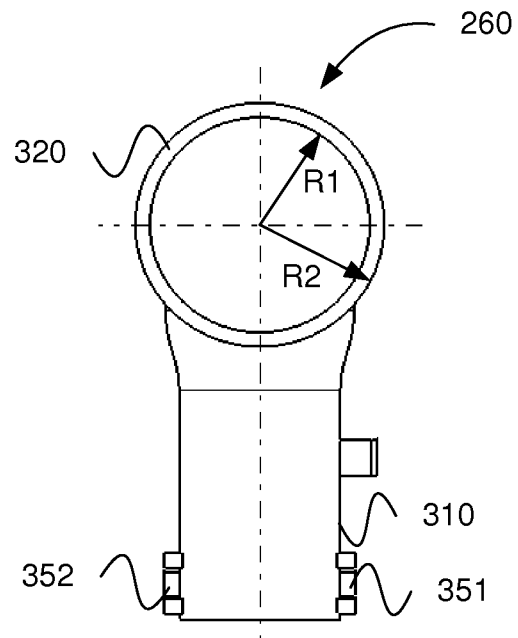


Fig. 3b

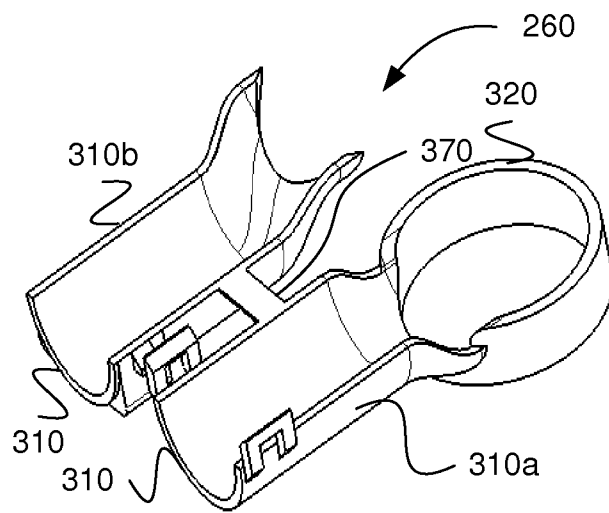


Fig. 3c

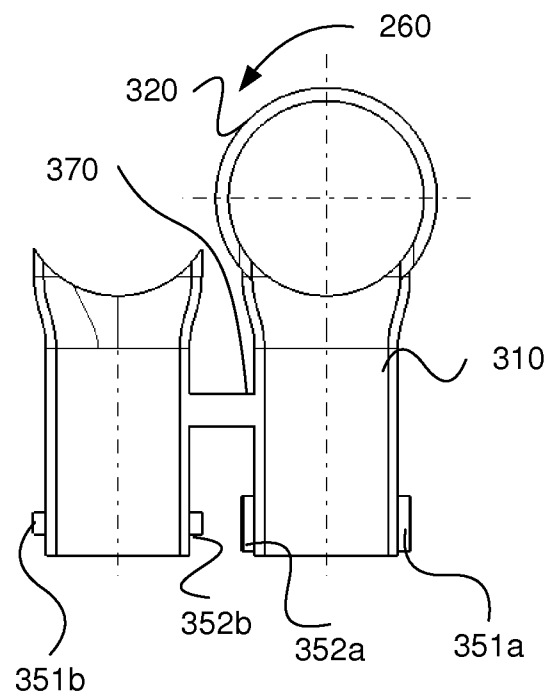


Fig. 3d

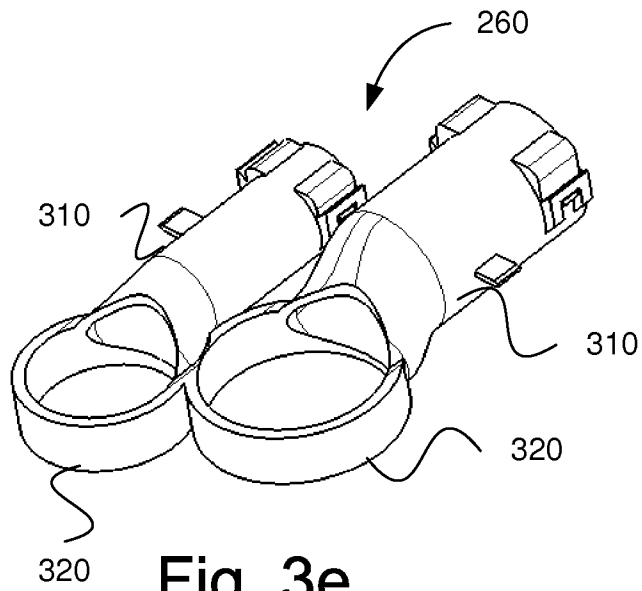


Fig. 3e

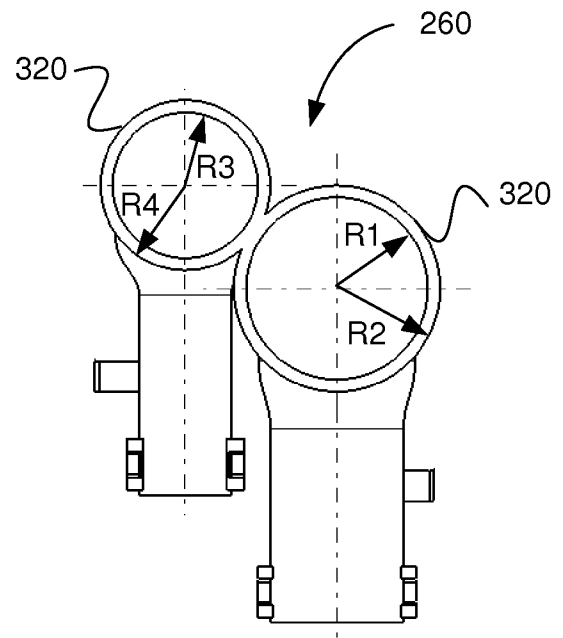


Fig. 3f

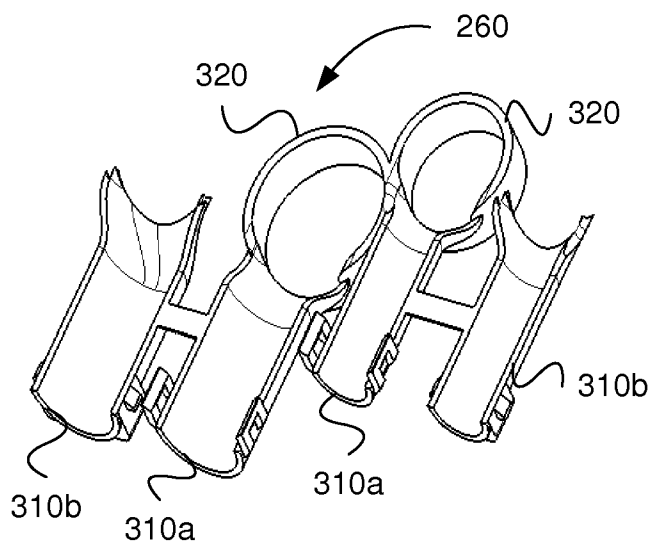


Fig. 3g

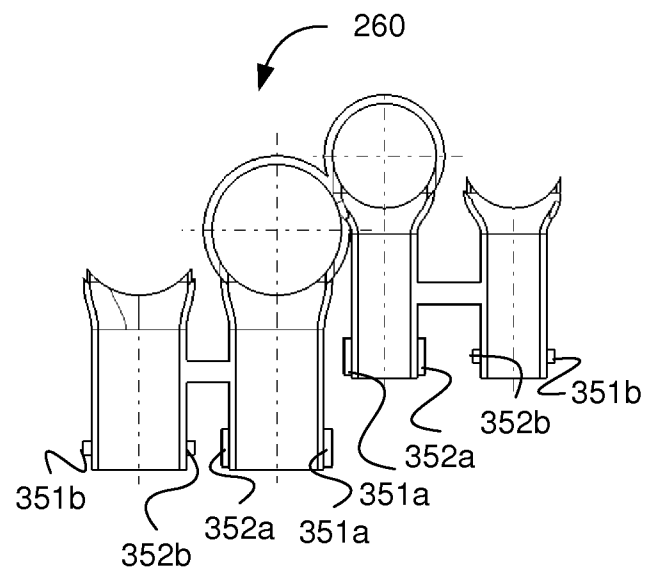


Fig. 3h

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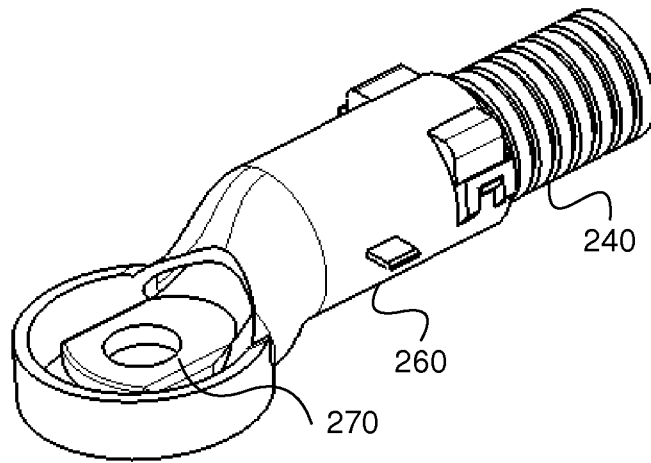


Fig. 3i

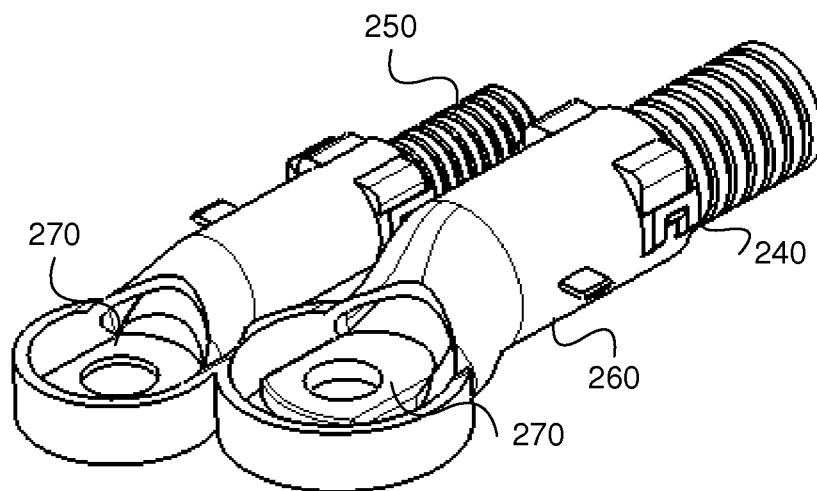


Fig. 3j

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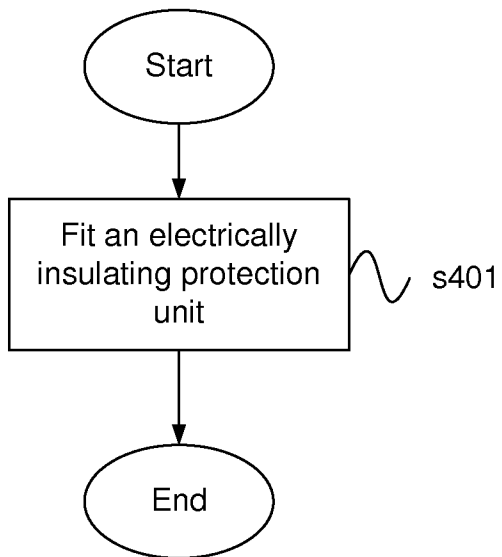


Fig. 4a

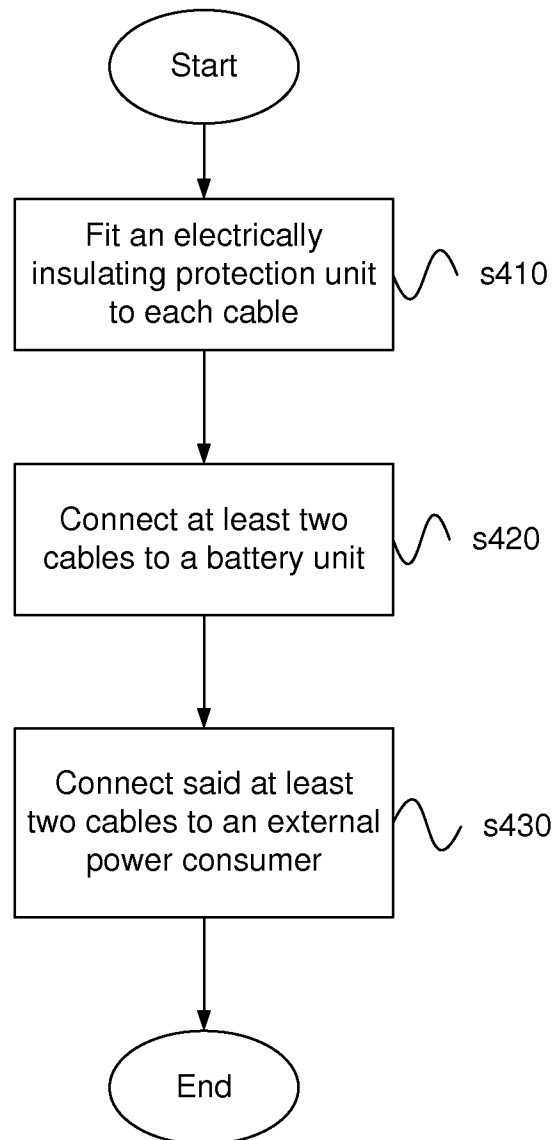


Fig. 4b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/050812

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: H01R

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.
X	JP 2008077839 A (YAZAKI CORP), 3 April 2008 (2008-04-03); figures --	1-15
X	US 20030224638 A1 (NISHIMOTO CHIKAO), 4 December 2003 (2003-12-04); paragraphs [0001]-[0017]; figures --	1-15
X	US 5413500 A (TANAKA TSUTOMU), 9 May 1995 (1995-05-09); column 1, line 17 - column 3, line 56; figures --	1-15
X	US 5804770 A (TANAKA TSUTOMU), 8 September 1998 (1998-09-08); paragraphs [0007]-[0009]; figures 1,2 --	1-15

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

* Special categories of cited documents:

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

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"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

27-11-2013

Date of mailing of the international search report

28-11-2013

Name and mailing address of the ISA/SE

Patent- och registreringsverket

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/050812

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20120103684 A1 (MAGUIRE PATRICK DANIEL ET AL), 3 May 2012 (2012-05-03); column 1, line 65 - column 4, line 61; figures --	1-15
A	US 5439759 A (LIPPERT SAMUEL A ET AL), 8 August 1995 (1995-08-08); column 1, line 57 - column 3, line 39; figures -- -----	1-15

Continuation of: second sheet**International Patent Classification (IPC)*****H01R 4/22*** (2006.01)***H01R 11/12*** (2006.01)***H01R 13/42*** (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2013/050812

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			EP	0765005 B1	29/03/2000
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