(12) UK Patent Application (19) GB (11) 2634026 (13) A

(43) Date of A Publication 02.04.2025

(21) Application No: 2314727.5

(22) Date of Filing: 26.09.2023

(51) INT CL:
B60L 53/31 (2019.01)

(56) Documents Cited:
CN 211641889 U
CN 110154815 B
US 20210252989 A1

(58) Field of Search:
INT CL **B60L**
Other: **SEARCH-PATENT**

(71) Applicant(s):
PeopleEV Limited
2 High Briton Street, Withernsea, East-Riding, Yorkshire, HU19 2HL, United Kingdom

(72) Inventor(s):
Dana Brown

(74) Agent and/or Address for Service:
ABION UK LIMITED
The Forum, 33 Gutter Lane, London, EC2V 8AS, United Kingdom

(54) Title of the Invention: **Apparatus and method**
Abstract Title: **Electric vehicle charging arrangement with liftable column and pivotable arm**

(57) Electric vehicle charging apparatus (Fig.1, 2) comprising a support column 8 movable between a lower (Fig.1) and a raised condition (Fig.2), an arm 12 connected to the support column and arranged to pivot from a first stowed position (Fig.2) to a second operational position (Fig.4). An expandable device 40 in the support column moves the support column from the lower to the raised condition. The support column may include first and second parts 8a and 8b, the first movable relative to the second part. The upper region of the support column may have a pivot joint 10 connecting the support column to the arm. The pivot joint may include a resilient device 14 biased to the second position. The apparatus may have illumination means 16 at the top end of the support column, which may be connected to a motion sensing device 17. The apparatus may have retention means (Fig.1, 20) for securing an end region of the arm opposite an end of the arm connected to the pivot joint when the arm is in the first stowed position. The arm may be telescopic. The apparatus may further comprise a user interface 63 to operate the apparatus, through which the user may identify themselves, which may allow the unlocking of the arm from the retention means. When the arm pivots, it may connect a vehicle charging cable (Fig.4, 24) to an electric vehicle charging connection means 22 at an end region of the arm.

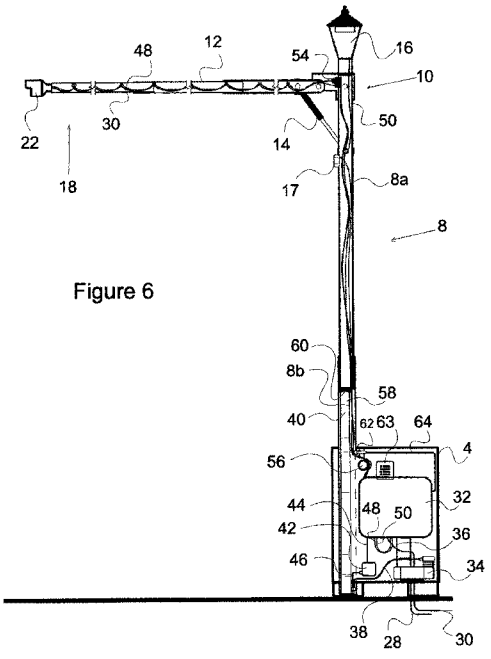
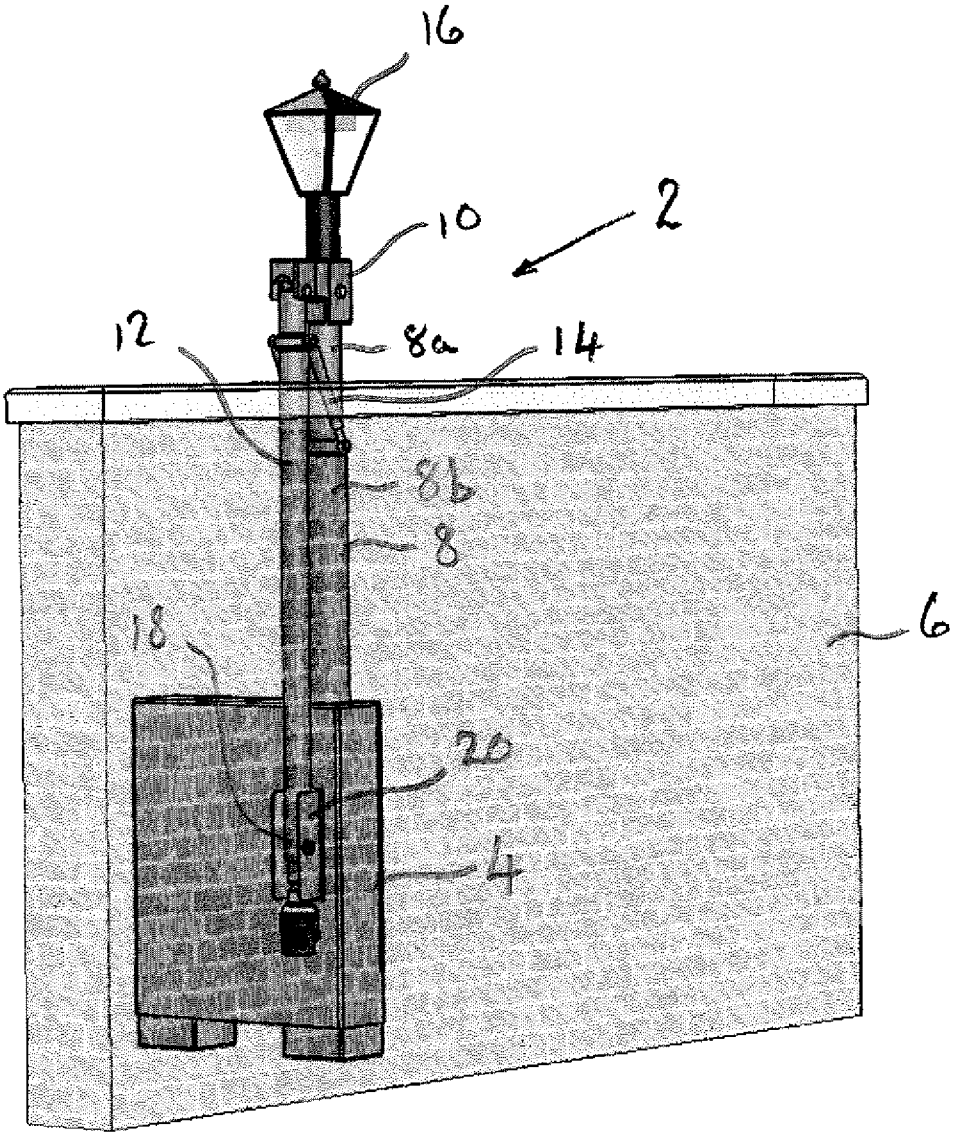


Figure 6

GB 2634026 A

Figure 1



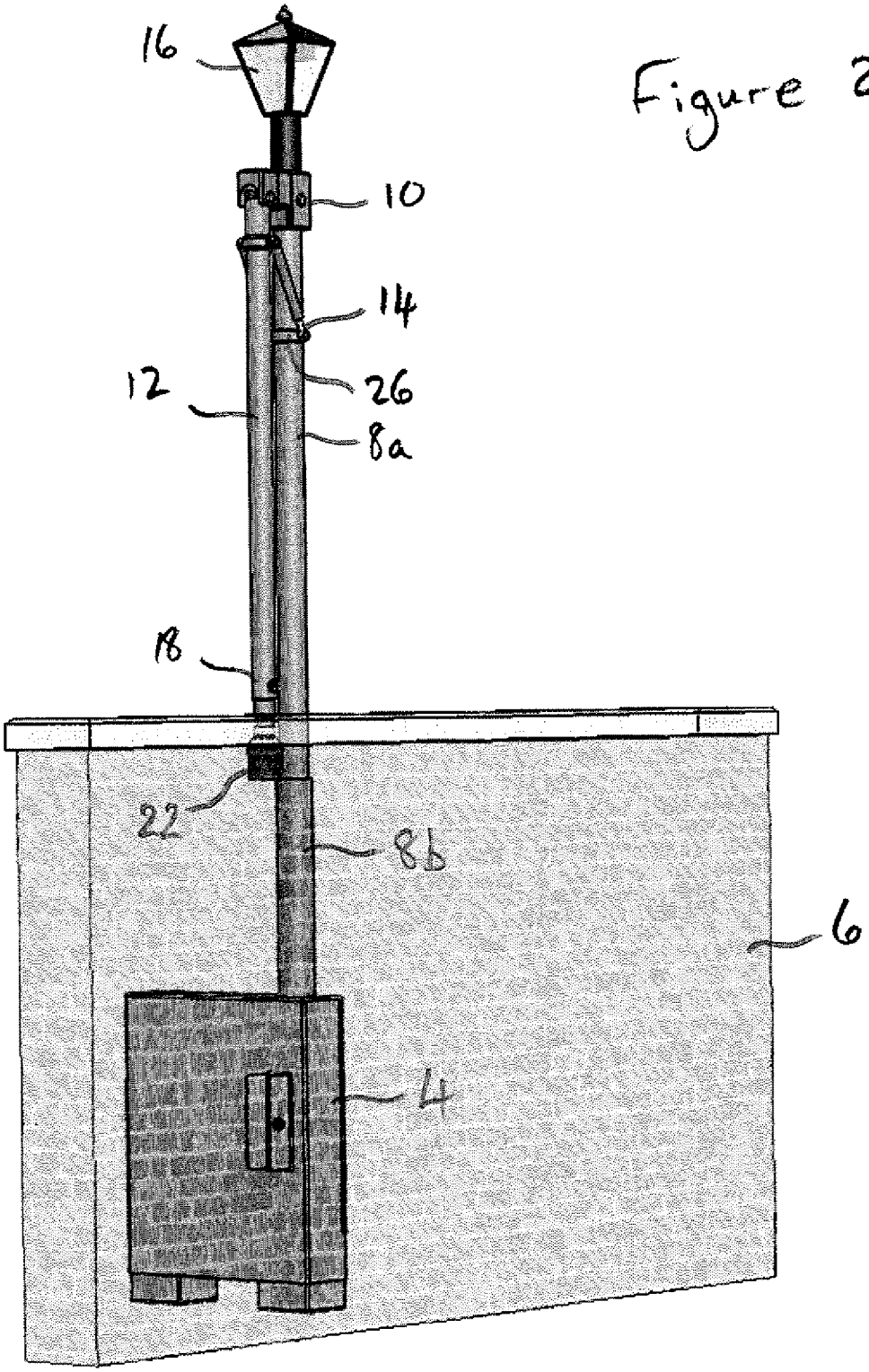


Figure 2

Figure 3

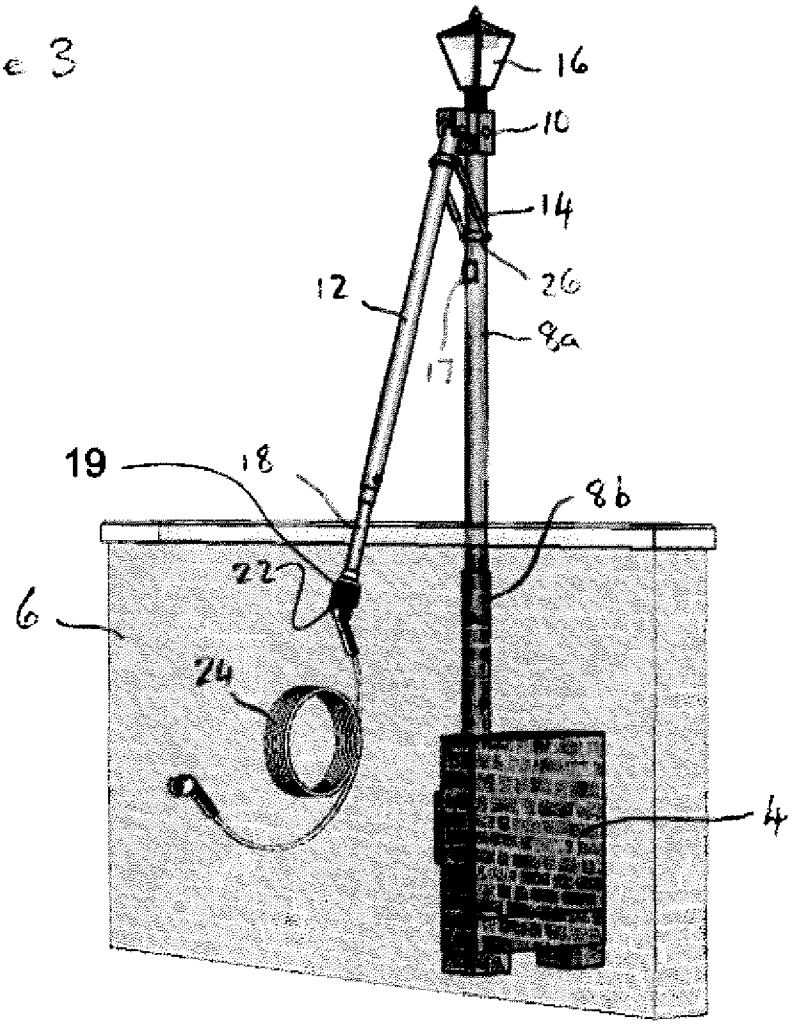
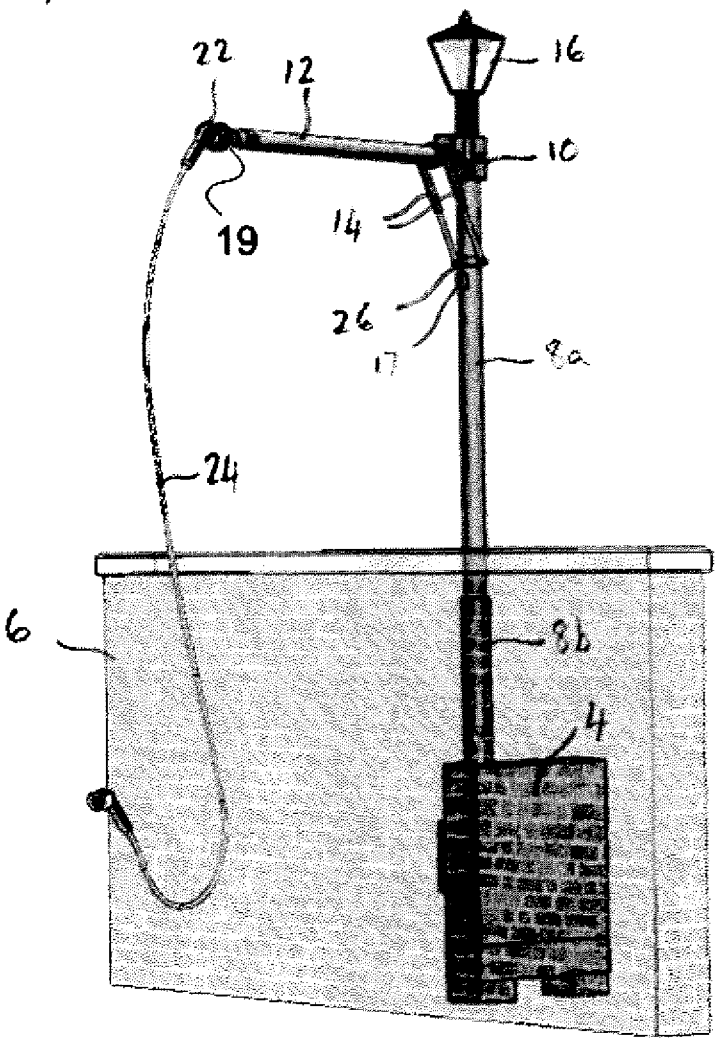


Figure 4



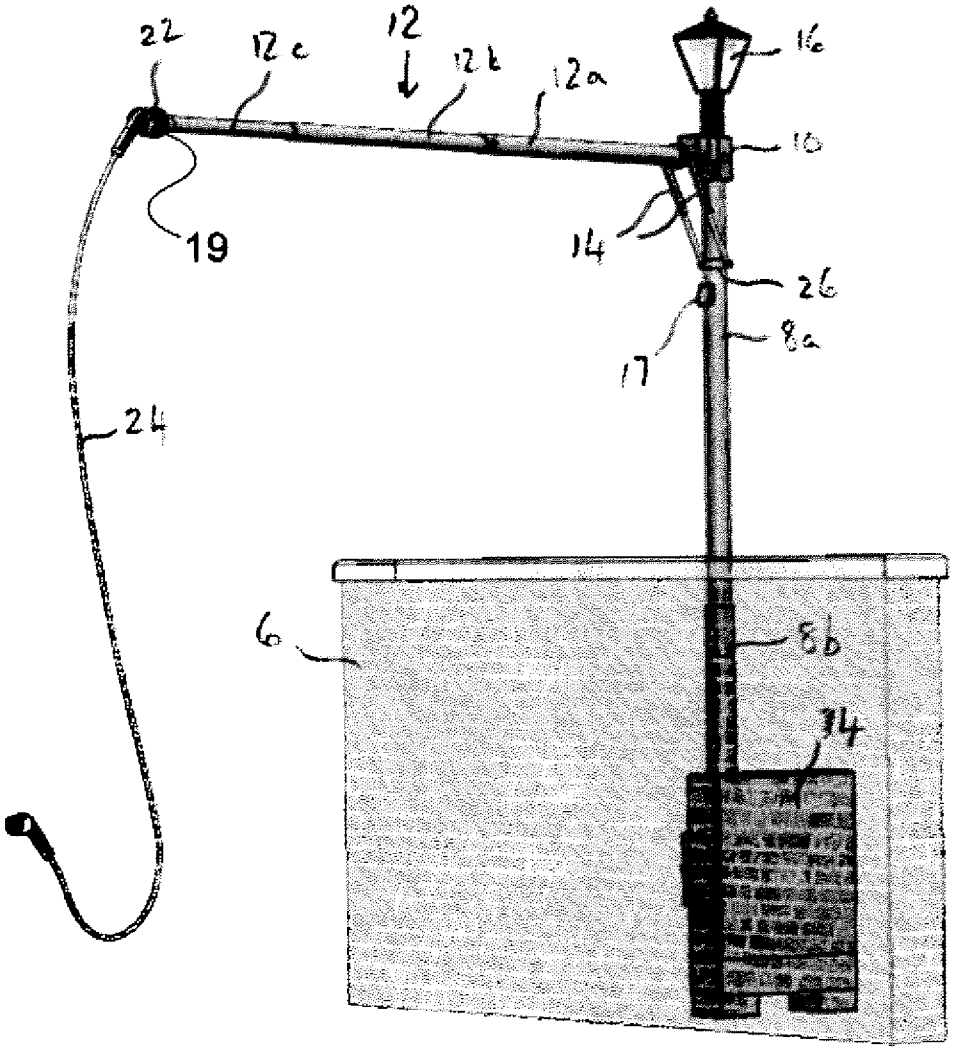


Figure 5

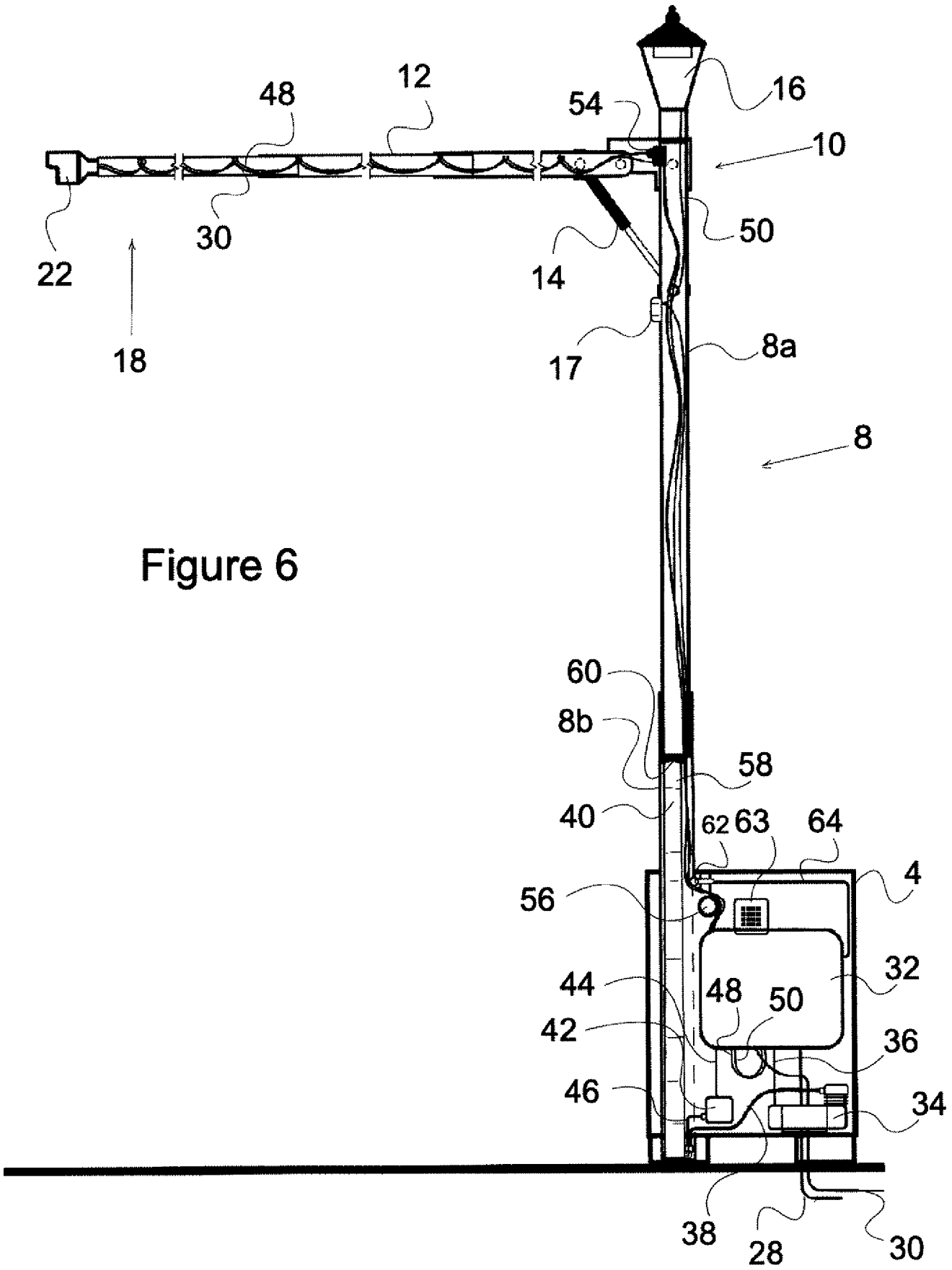

48
12
54
16
10
30
50
22
14
18
17
8a
8
60
8b
58
40
62
63
64
4
56
32
44
48
50
42
36
46
34
38
28
30

Figure 6

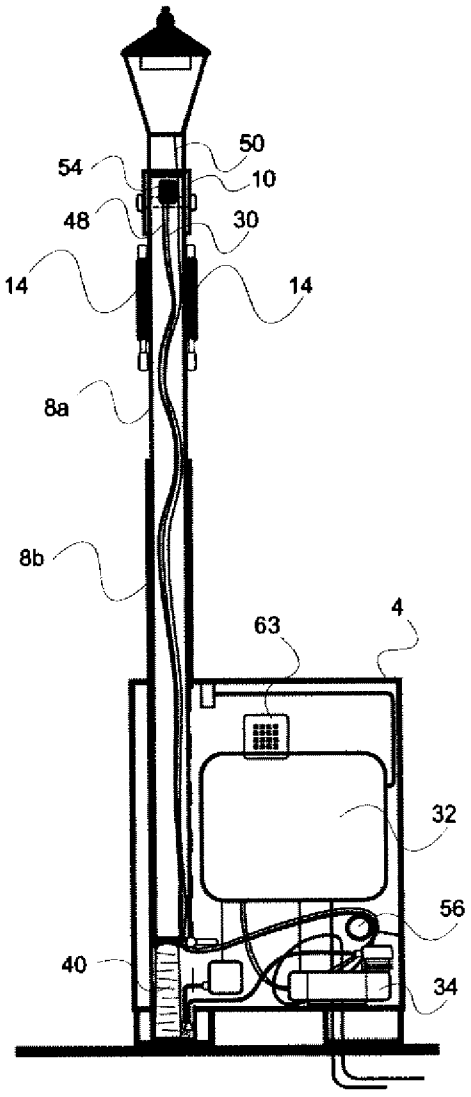


Figure 7

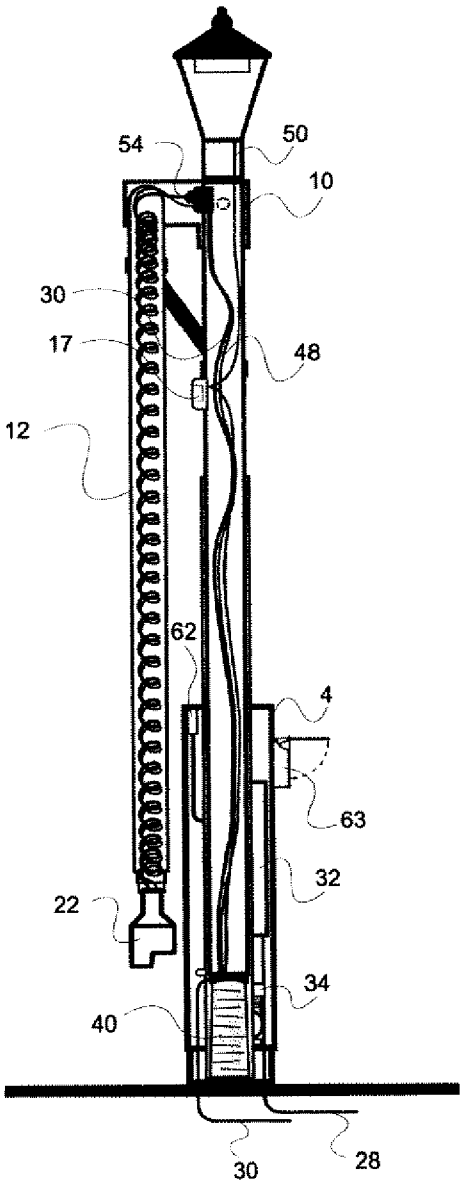


Figure 8

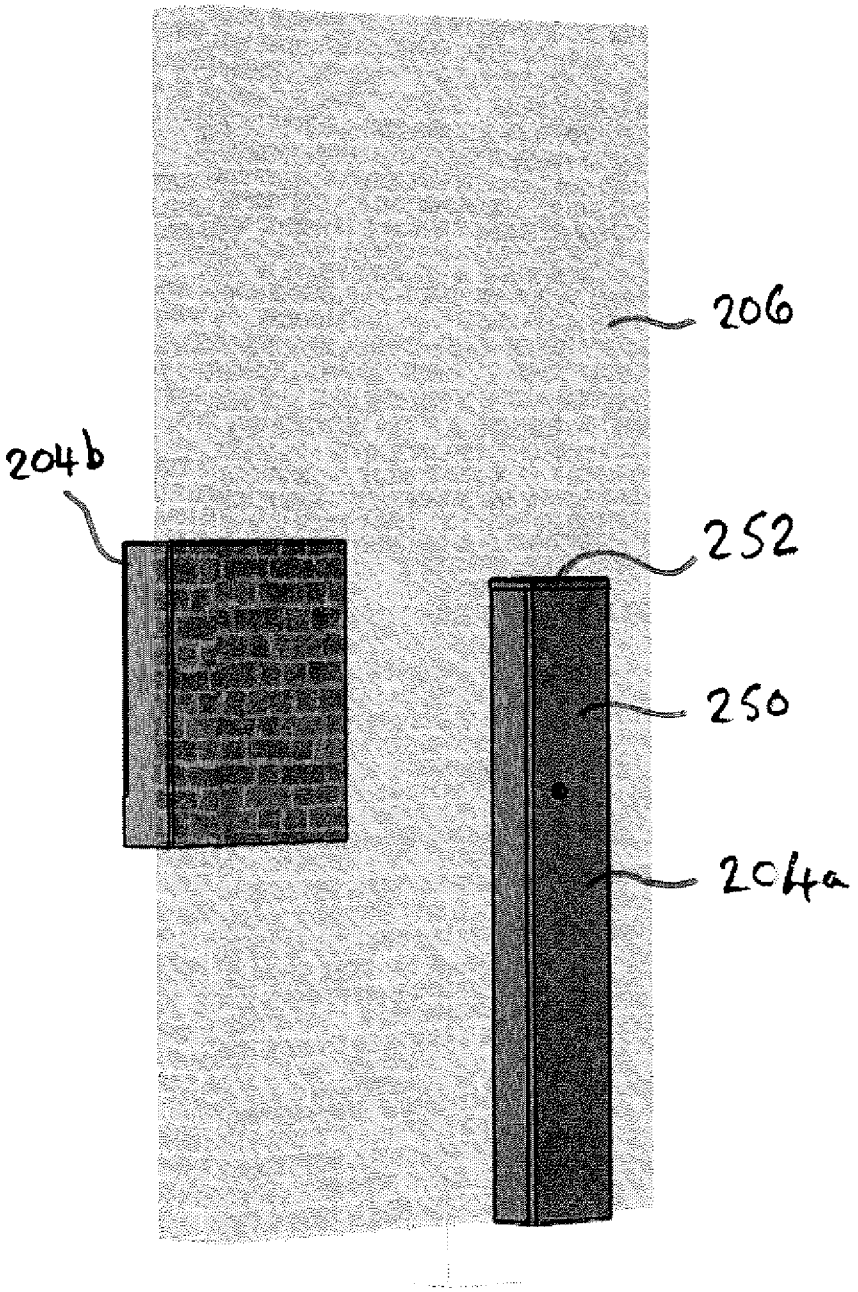


Figure 9

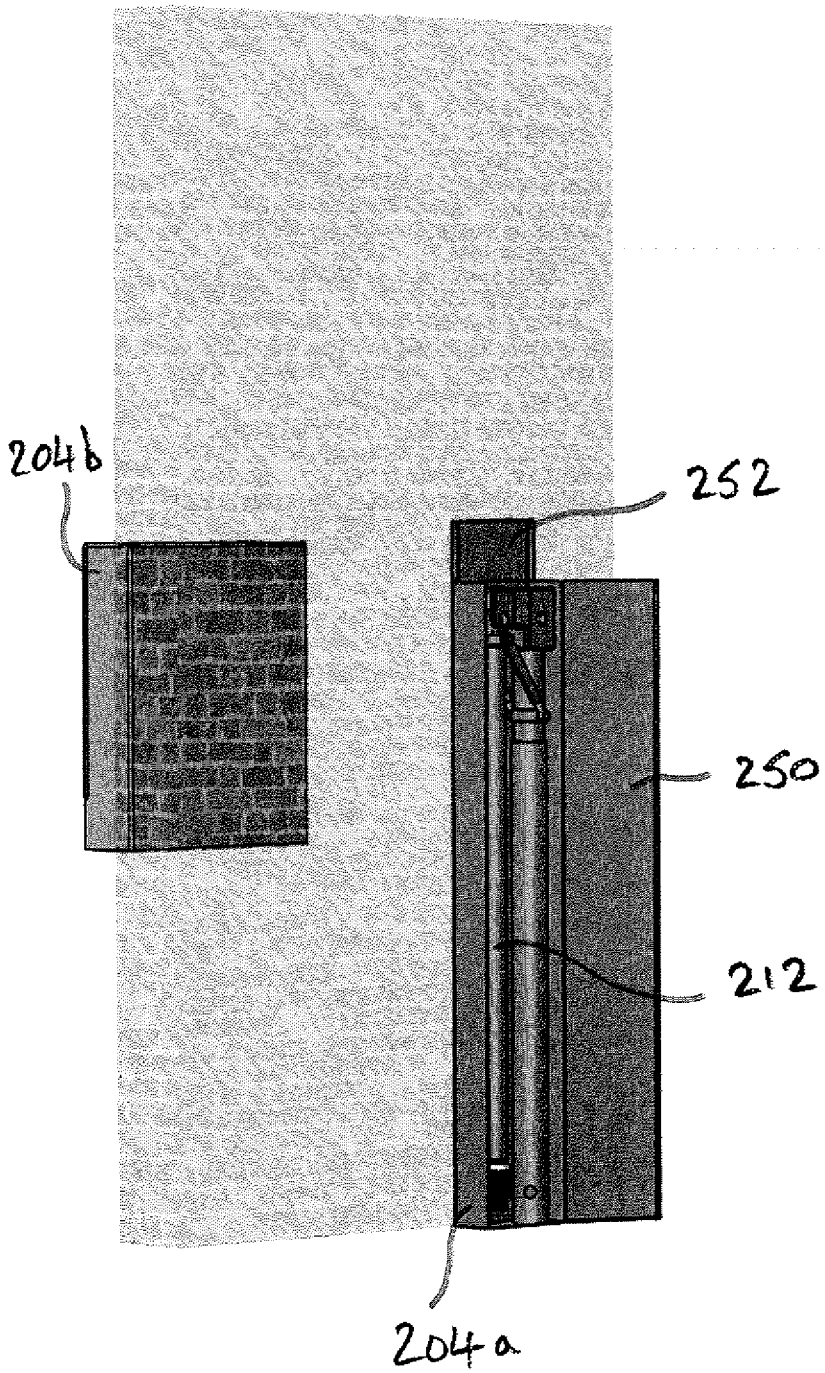


Figure 10

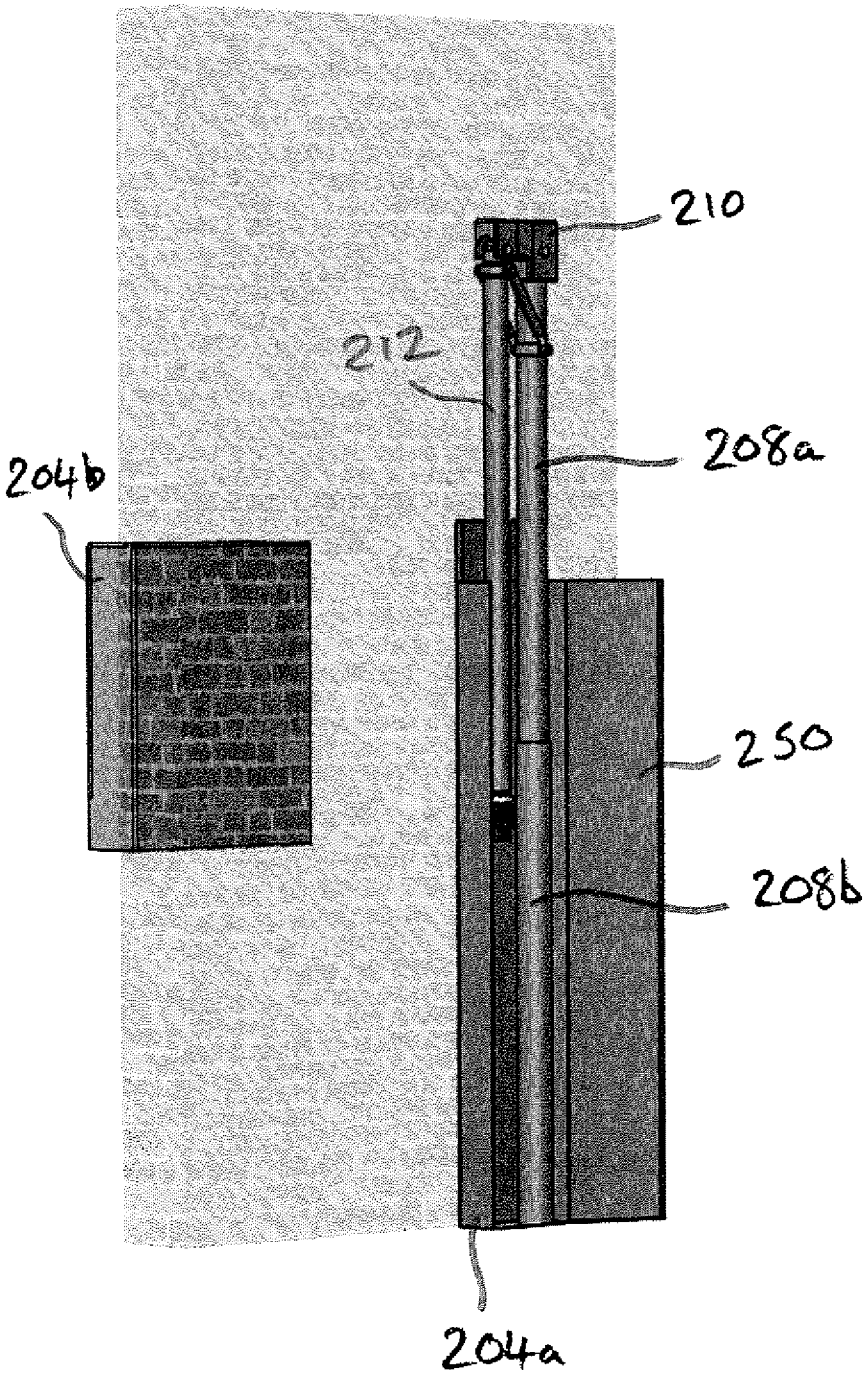


Figure 11

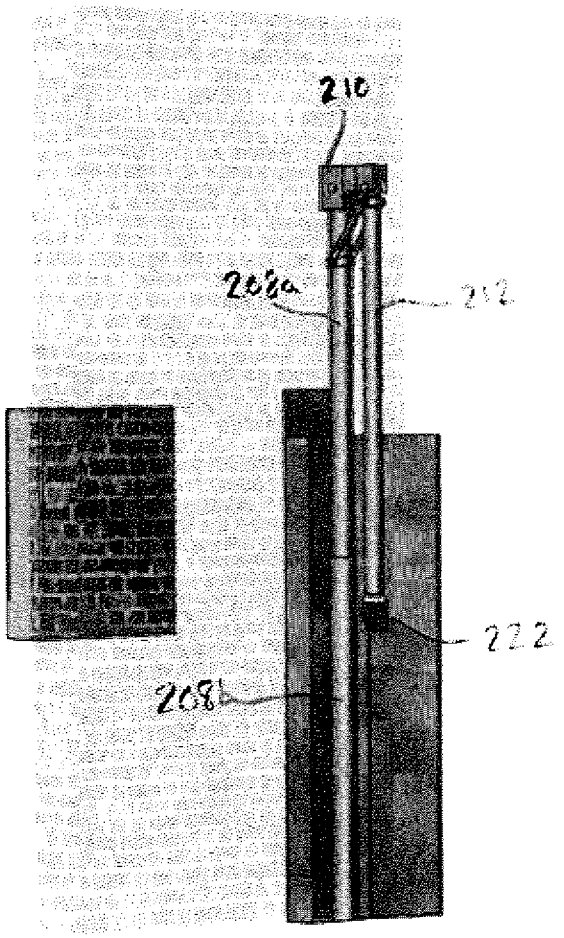


Figure 12

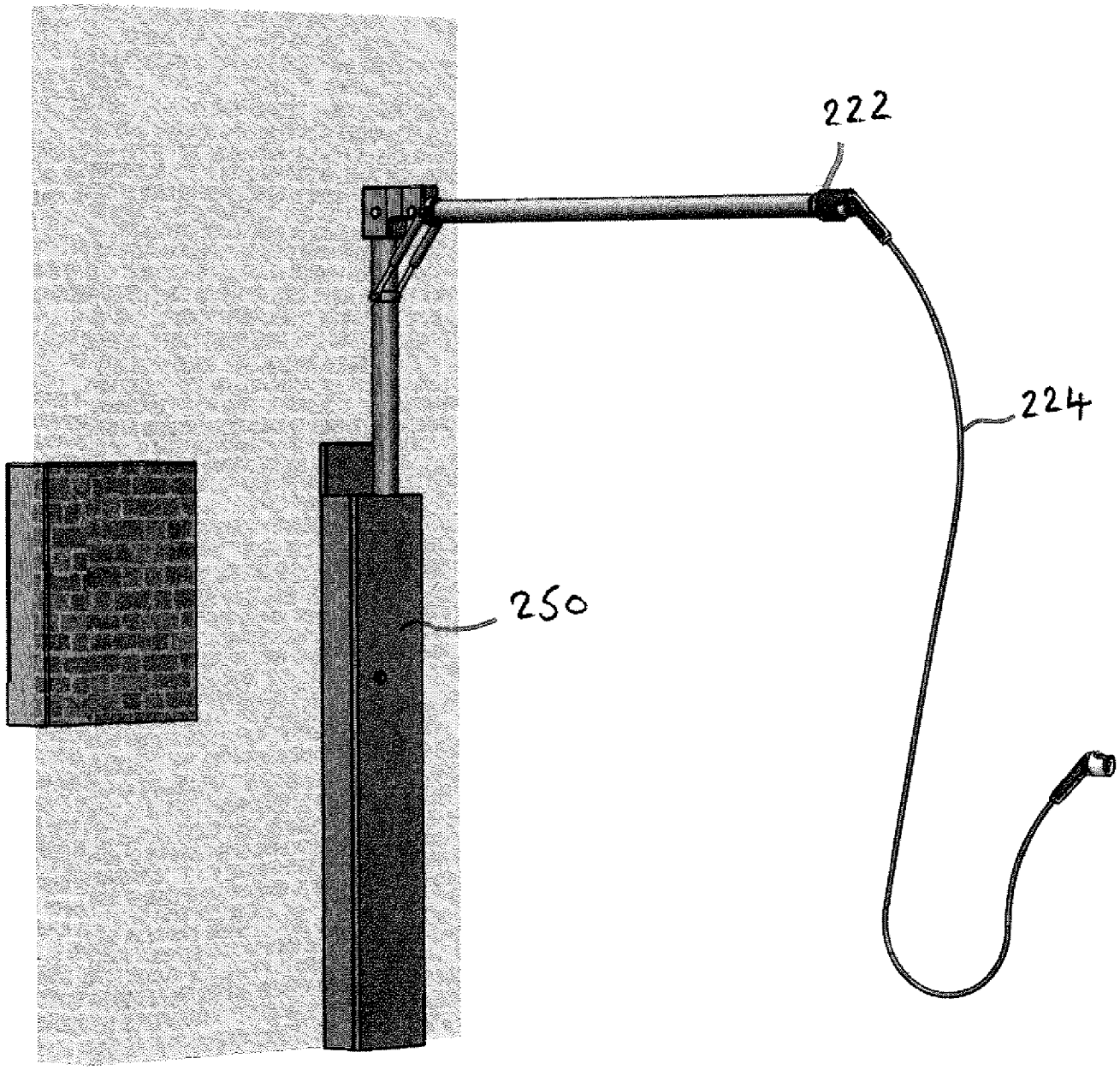


Figure 13

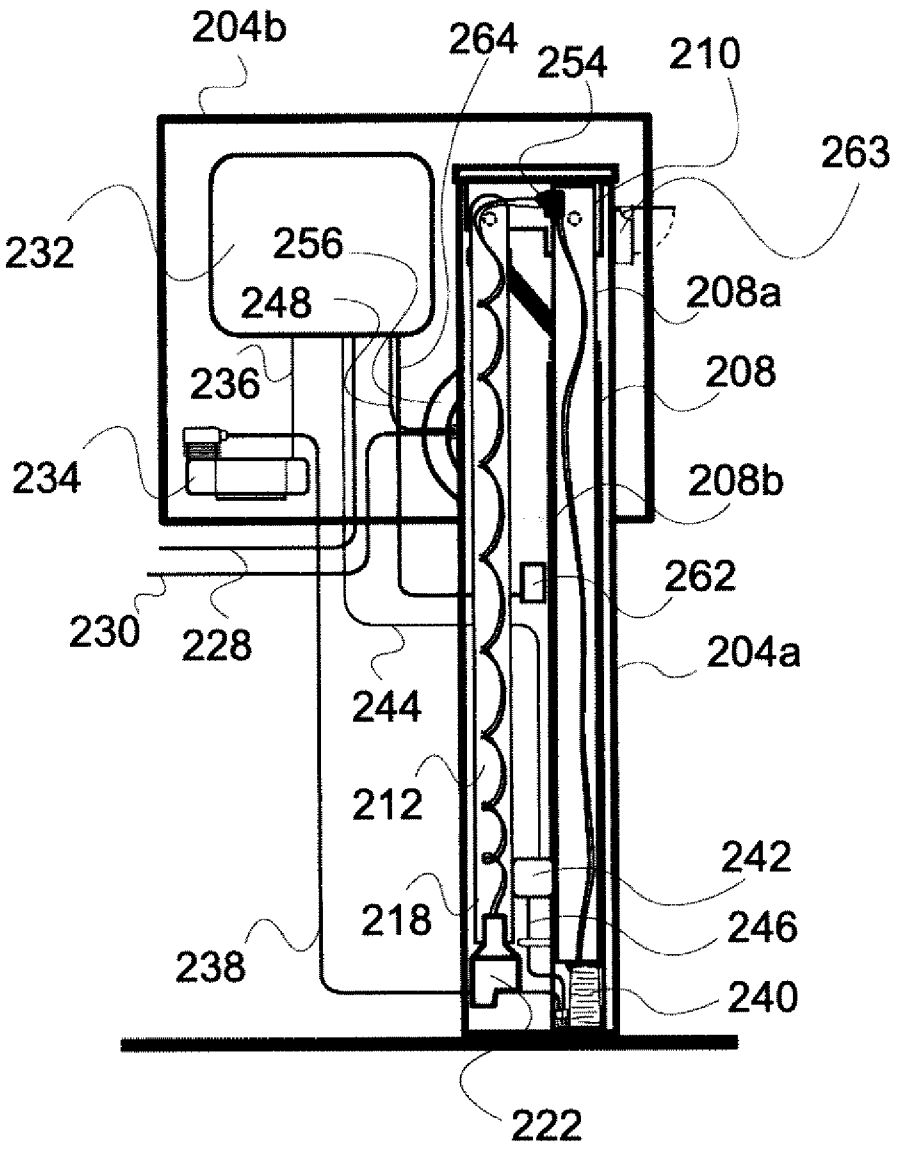

204b
264
254
210
263
232
256
248
208a
236
208
234
208b
262
230
228
204a
244
212
242
218
246
238
240
222

Figure 14

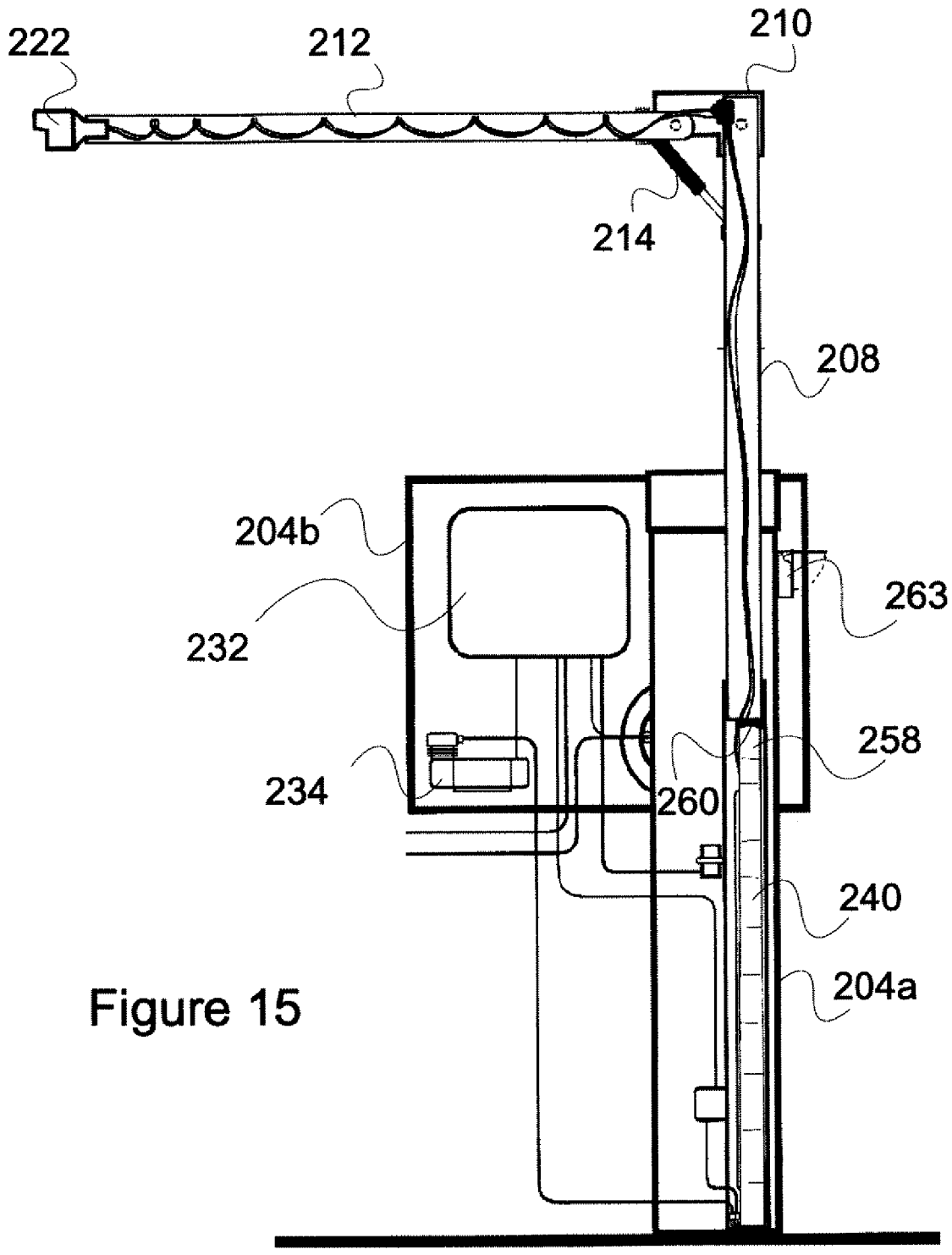


Figure 15

APPARATUS AND METHOD

This invention relates to apparatus and a method of charging an electric vehicle, particularly one where a driveway or off-street parking is not available to position the vehicle upon.

Where owners of electric vehicles reside in terraced housing or housing with no driveway but has available street parking outside the property, in order to be able to charge the vehicle, charging cables would have to cross public footpaths and/or grass areas and thus provide a hazard to members of the public passing by. This is not a situation which most local authorities, in charge of public safety, allow.

It is known to construct a channel in the ground surface to house the charging cable below ground surface level, so that it does not form a trip hazard. One major disadvantage of this type of installation is that the cable is subject to ground movement and may form an electrical hazard.

It is also known to provide a device that supports the charging cable at a height above the ground surface. The problem with these types of arrangement is that they are intrusive and often encroach on the public space whilst being deployed, which is not safe for passers-by. In addition, they are not aesthetically pleasing, nor do they fit-in with the surrounding architectural features. Additionally, these types of arrangements are very tall and made of metal, top to bottom. Potentially creating a lightening hazard.

According to a first aspect of the present invention, there is provided electric vehicle charging apparatus comprising a support column movable between a lower and a raised condition, an arm connected to the support column and arranged to pivot from a first stowed position to a second operational position, and an expandable device in the support column for moving the support column from the lower to the raised condition.

According to a second aspect of the present invention, there is provided a method of charging an electric vehicle, comprising moving a support column from a lower condition to a raised condition, pivoting an arm connected to the support column from a first stowed position to a second operational position, wherein the moving the support column from the lower to the raised condition includes expanding an expandable device.

Owing to these aspects, an electrical car charging arrangement can be expandably deployed from a stowed position to an operational position.

Preferably, in the first stowed position, the arm is arranged substantially parallelly to the support column.

Preferably, in the second operational position, the arm is pivoted away from the support column and, advantageously substantially orthogonal to the support column.

In particular, the support column and arm enable an electric vehicle charging cable to be deployed at a suitably safe height above a pathway, walk-way or the like to bridge that pathway so that people passing beneath do not experience any potential hazard. The arrangement is particularly useful for charging an electrical vehicle where the user/owner lives in a dwelling where there is no driveway, for instance in a row of terraced housing.

The arrangement is also particularly useful for charging electrical vehicles overnight when the cost of electricity is relatively low.

In order that the present invention can be clearly and completely disclosed, reference will now be made, by way of example only, to the accompanying drawings, in which:-

Figures 1 to 5 are perspective views of a first embodiment of an electric vehicle charging arrangement showing the transition from a stowed condition to an operational condition;

Figures 6 to 8 are schematic cross-sectional views of the first embodiment;

Figures 9 to 13 are views similar to Figures 1 to 5, but of a second embodiment; and

Figures 14 to 15 are views similar to Figures 6 to 8, but of the second embodiment.

Referring to Figures 1 to 5, an electric vehicle charging arrangement 2 comprises a power supply unit 4 which is electrically grounded and can be supported on a suitable standing and/or mounted to a substantially vertical wall surface 6 of a dwelling of an electric vehicle user/owner (the power supply unit 4 shown in the Figures located behind the wall 6). The arrangement 2 also comprises a support column 8 extending substantially vertically upwardly from the power supply unit 4, the support column 8 including first and second parts 8a, 8b in the form of tubular parts, the first part 8a being movable relative to the second part 8b by virtue of being located within the

second part 8b. At an upper end region of the support column 8 opposite the power supply unit 4, a pivot joint 10 connects the support column 8 to an arm 12. The pivot joint 10 enables the arm 12 to be pivoted from a first stowed position or configuration (as shown in Figure 1) to a second operational position or configuration (shown in Figures 4 and 5), the pivoting of the arm 12 being controlled by a resilient device 14 in the form of a spring-type device, such as the at least one gas spring devices shown in the Figures (a pair of such gas spring devices being shown). At the top end of the support column and attached to the first part 8a, an illumination means 16 is provided. The illumination means 16 is, advantageously, lighting which minimizes glare, reduces light trespass, and doesn't pollute the night sky during overnight use of the arrangement 2. This lighting is preferably LED lighting switched on by way of a motion sensing device 17 connected to the illumination means 16 and thereby illuminates the pathway or passageway only when the motion sensing device 17 detects motion in the proximity of the arrangement 2. The lighting will remain on for a set period of time and then be switched off once motion is no longer detected by the sensing device 17.

Referring to Figure 1, when the arm 12 is in the stowed configuration, an end region 18 of the arm 12 opposite an end of the arm 12 connected to the pivot joint 10 is secured in such configuration by retention means 20 of any suitable form which, as shown, may be located on an outer surface of the power supply unit 4. In addition, when in the stowed configuration, the arm 12 is arranged substantially parallelly to and adjacent the support column 8. The arm 12 is advantageously locked in the retention means 20 until a user wishes to operate the arrangement 2. When in the operational configuration, the arm 12 is arranged substantially orthogonal to the support column 8 (see Figures 4 and 5). The resilient device 14 is biased to bring the arm 12 into the operational configuration, such that the resilient device is under tension in the stowed configuration and starts to move into the operational configuration once unlocked from the retention means 20.

When the first part 8a of the support column 8 is caused to move relative to the second part 8b in an upward direction the pivot joint 10 is raised to a desired and/or set height. Such a preferred height is around 3.05m above the ground or floor. The end region 18 of the arm 12 includes a standard electric vehicle charging connection means 22 connectable with a charging cable 24 that leads to the electric vehicle being charged. The electrical cables within the arm 12 and the support column 8 (see Figures 6 to 8

described hereinbelow) are the same rated coaxial cable type as used by a home electric vehicle charger which ensures that the same electric vehicle charging safety protocols as a direct charger-to-vehicle connection.

The arm 12 has the option to be a telescopic arm with arm sections 12a, 12b, 12c (see Figure 5) allowing the arm to reach over a relatively wide pathway or similar space to reach the electric vehicle at a kerb-side, for instance. In such an instance the cable within the arm 12 is coiled and resiliently mounted within the arm 12 so that the cable can be extended and recoiled as required.

The end region 18 of the arm 12 may further include a light 19 of suitable type in order that it can be clearly seen during overnight charging by pedestrians and/or drivers of other road users.

Referring to Figures 6 to 8, the power supply unit 4 is powered by an electrical supply from an electrical supply cable 28 which may be installed beneath the surface of the ground or floor or in any other suitably safe manner. An electric vehicle charging cable 30 is also received by power supply unit 4 and which extends therethrough. The cable 28 is connected as an input cable to a control box 32, which is advantageously a low voltage control box including the necessary electrical components. A fluid displacement device 34 in the form of an air pump is connected to the control box 32 for power supply by way of a first output cable 36 and the air pump 34 is further connected by way of a suitable conduit 38 to an end region of an expandable device 40 located within the second part 8b of the support column 8. A solenoid valve 42 is also connected for power supply to the control box 32 by way of a second output cable 44 and to the end region of the expandable device 40 by a further suitable conduit 46. In this way the solenoid valve 42 is able to control the amount of air being pumped from the air pump 34 to the expandable device 40. Third and fourth output cables 48 and 50 to supply electrical power the light at the end region 18 of the arm 12 and the motion sensor 17 and light 16 respectively lead from the control box 32 and through the support column 8. The electric vehicle charging cable 30 which extends through power supply unit 4 for supplying power to the electric vehicle charging connection means 22 extends parallelly to the third and fourth output cables 48 and 50 and the electric vehicle charging cable 30 and the third output cable 48 further extend through the arm 12 to the end region 18 by way of a plug-and-socket connection means 54

located within the pivot joint 10. The power supply unit 4 also includes a cable management system 56 to retain the various electrical cables in an area where they will not be mechanically damaged by moving parts when the expandable device 40 is inflated and deflated with air.

A top end region 58 of the expandable device 40 is in contact with and located centrally of an underside zone of a bottom end region 60 of the upper part 8a of the support column 8, the arrangement being such that as air is pumped into the expandable device 40 which then begins to expand within the support column 8, the contact between the expandable device and the bottom end region 60 causes the upper part 8a to raise upwardly and therefore raise the pivot joint 10. The reverse is true when air is removed from the expandable device 40 by way of the solenoid valve 42 and the further suitable conduit 46.

In order to control the raising of the upper part 8a, a position sensor 62 is located within the power supply unit 4 and connected to the control box 32 by way of a sensor cable 64. When the position sensor 62 detects that the upper part 8a has been raised to a set maximum, it will send a shut-off signal to the air pump 34 to prevent any more air from being pumped into the expandable device. The position sensor is preferably a magnetic sensor whereby a first magnetic part of the sensor is positioned on a lower region of the upper part 8a and when the upper part 8a is extended upwardly by inflation of the expandable device 40 the first magnetic part is magnetically detected by a second magnetic part located towards the top end region inside the power supply unit 4. The position sensor 62 can be adjustable in respect of the maximum height reached by the pivot joint 10 depending upon any existing overhead obstacles that might be present, such as a tree branch for instance. The position sensor 62 also ensures that if the pivot joint is somehow lowered, through extremely high wind loading or indeed a third party interfering with the arrangement 10, it will automatically start the air pump to inflate the expandable device 40 further in order to restore the set height.

When the end region 18 of the arm 12 and the electric vehicle charging connection means 22 are freed from the retention means 20 in the transition from the stowed configuration to the operational configuration, the pivot joint 10 is arranged to be rotationally movable around the longitudinal axis of the support column 8. In this

respect, the resilient means 14 are also arranged to similarly rotate about the support column 8 and are at one end of the resilient means mounted to a collar 26 (see Figures 2 to 5) substantially surrounding the support column 8. In this way, the arm 12, once it is freed from the retention means 20 can be rotationally moved relative to the support column 8 to enable the arm to be moved to a position proximal to the electric vehicle to be charged.

A user interface 63 in the form of a key-pad device is operable to perform a plurality of functions, including unlocking the arm 12 from the retention means 20, and operating the air pump and the solenoid valve 42 to raise and lower the pivot joint 10. Advantageously, the user has to enter a PIN code or identify themselves in another suitable way, to be able to operate the charging arrangement 2.

In addition, once the expandable device 40 is operated to extend the upper part 8a upwardly to the desired position, the user interface is configured to go into a locked mode and only by the user identifying themselves, can the charging arrangement be operated again to either raise further or lower the pivot joint 10.

Referring to Figures 9 to 13, a second embodiment of the electric vehicle charging arrangement 202 comprises a storage unit 204a forming retention means 220 (see Figures 9 to 13) for the support column 208 and the arm 212, and a power supply unit 204b, electrically grounded, for housing substantially all of the same electrical equipment in the power supply unit 4 described hereinabove with reference to Figures 6 to 8, but also referred to with reference to Figures 14 and 15 below. The storage unit 204a and the power supply unit 204b may be mounted on the same side of the wall 206 or, as shown on opposite sides of the wall 206. Preferably, the power supply unit 204b is mounted inside a dwelling and connects with a plug into the domestic electrical supply. The storage unit 204a is provided with a first obturating panel 250 and a second obturating panel 252, the first obturating panel being openable to reveal the support column 208 and the arm 212 in the stowed configuration with the arm 212 lying substantially parallelly to and adjacent the support column 208. The second obturating panel 252 closes the top end of the first power supply unit 204a to ensure that the support column 208 and arm 212 can be closed off from the outside atmospheric conditions. In this embodiment, the arm 212 is retained in its stowed configuration by the walls of the storage unit 204a.

As with the first embodiment, an upper end region of the support column 208 a pivot joint 210 connects the support column 208 to the arm 212. The pivot joint 210 enables the arm 212 to be pivoted from the stowed configuration (as shown in Figures 9 and 10) to the operational configuration (shown in Figure 13), the pivoting of the arm 212 being controlled by a resilient device 214 in the form of a spring-type device, such as the at least one gas spring devices shown in the Figures (a pair of such gas spring devices being shown). Again, as with the first embodiment, the resilient device 214 is biased to the operational configuration. During use of the charging arrangement 202 the pivot joint only needs raising upwardly a small amount to clear the top end of the storage unit 204a before the arm 212 can be manually swung outwardly. This is particularly advantageous for disabled users in wheelchairs because at that stage, the electric vehicle charging connection means 222 is still located at a low level to be able to connect the vehicle charging cable 224 thereto.

Figure 13 shows the second embodiment of the electric charging arrangement in the operational configuration, with the obturating panel 250 closed, with the charging cable 224 connected to the electric vehicle charging connection means 222.

Referring to Figures 14 and 15, the power supply unit 204b is powered by an electrical supply from an electrical supply cable 228. An electric vehicle charging cable 230 is also received by the power supply unit 204b and extends therethrough by way of a cable management system 256 to the support column 208. The cable 228 is connected as an input cable to a control box 232, which is advantageously a low voltage control box including the necessary electrical components. A fluid displacement device 234 in the form of an air pump is connected to the control box 232 for power supply by way of a first output cable 236 and the air pump 234 is further connected by way of a suitable conduit 238 to an end region of an expandable device 240 located within the second part 208b of the support column 208. A solenoid valve 242 located in the storage unit 204a is also connected for power supply to the control box 232 by way of a second output cable 244 and to the end region of the expandable device 240 by a further suitable conduit 246. In this way the solenoid valve 242 is able to control the amount of air being pumped from the air pump 234 to the expandable device 240. A third output cable 248 to supply electrical power the light at the end region 218 of the arm 212 leads from the control box 232 and through the support column 208 by way of the cable management system 256. The electric vehicle charging cable 230 which

extends through power supply unit 204b for supplying power to the electric vehicle charging connection means 222 extends parallely to the third output cable 248 and further extend through the arm 212 to the end region 218 by way of a plug-and-socket connection means 254 (see Figure 14) located within the pivot joint 210.

A top end region 258 (see Figure 15) of the expandable device 240 is in contact with and located centrally of an underside zone of a bottom end region 260 of the upper part 208a of the support column 208, the arrangement being such that as air is pumped into the expandable device 240 which then begins to expand within the support column 208, the contact between the expandable device and the bottom end region 260 (see Figure 15) causes the upper part 208a to raise upwardly and therefore raise the pivot joint 210. The reverse is true when air is removed from the expandable device 240 by way of the solenoid valve 242 and the further suitable conduit 246.

In order to control the raising of the upper part 208a, a position sensor 262 is located within the power supply unit 204b and connected to the control box 232 by way of a sensor cable 264. When the position sensor 262 detects that the upper part 208a has been raised to a set maximum, it will send a shut-off signal to the air pump 234 to prevent any more air from being pumped into the expandable device 240.

A user interface 263 in the form of a key-pad device mounted to an external side of the storage unit 204a is operable to perform the same functions as for the user interface 63 of the first embodiment described hereinabove.

Both embodiments preferably include Wi-Fi/Bluetooth transceivers which communicate with a software application stored on a data processing device, such as a smartphone and/or tablet computing device.

The user is also preferably supplied with a key device to gain access to the power supply units 4 or 204b and also the storage unit 204a. Alternatively, or in addition, a key-pad can be supplied to gain access to those units and related control circuitry could allow operation of the electric vehicle charging arrangements.

The second embodiment is shown without illumination means, but it can be provided if required in a similar manner to that of the first embodiment and a corresponding motion sensor may also be used.

The second embodiment is tailored to be used with dwellings where the front entrance opens directly onto a pathway or similar passageway as is commonly found in city areas. The first embodiment as described above with reference to figures 1 to 8 is tailored to be used with dwellings which feature a front open space that may be bordered from the footpath or passageway by a wall, fence or similar physical boundary. Both therefore cater for people with no private off-street parking and so have to charge their electric vehicles at kerb-side locations. Both embodiments perform to provide the maximum protection set by, not only local and/or national authorities governing public safety, but also by the manufacturers of electric vehicles.

In the same way as the first embodiment, the end region 218 of the arm 212 may further include a light of suitable type in order that it can be clearly seen during overnight charging by pedestrians and/or drivers of other road users.

Both embodiments are especially useful for overnight charging of an electric vehicle keeping the public safe and taking advantage of lower cost electricity rates at those times.

In the stowed configuration, which is that which is intended to be, but not exclusively, during the daytime, minimizes the visual impact on the immediate environment at a time when most people are out and about.

Advantageously, all exterior parts of both embodiments are made from non-conducting materials for added safety.

The exterior power supply units 4 are preferably rated at IP54 or higher for protection of the electrical equipment inside and interior 204b power supply units are IP43 rated or higher.

The arrangement of both embodiments is designed to provide gentle overnight charging rather than high-powered charging and therefore has the beneficial effects of lowering the carbon footprint, reducing demand on the electrical grid and reducing the cost of operating an electrical vehicle. Gentle overnight charging also prolongs the life of the electrical vehicle batteries.

A further advantageous feature of each embodiment is that all cables and conduits are enclosed until the point where the charging cable 24, 224 is connected to the a standard electric vehicle charging connection means 22, 222. Furthermore, if there is

a break in the vehicle charging circuit, for example from acts of vandalism to the charging cable 24, 224, there is no danger of serious electrical accidents.

CLAIMS

1. Electric vehicle charging apparatus comprising a support column movable between a lower and a raised condition, an arm connected to the support column and arranged to pivot from a first stowed position to a second operational position, and an expandable device in the support column for moving the support column from the lower to the raised condition.
2. Apparatus according to claim 1, wherein the support column includes first and second parts, the first part being movable relative to the second part.
3. Apparatus according to claim 1 or 2, and further comprising a pivot joint at an upper end region of the support column connecting the support column to the arm and at which the arm pivots from the first stowed position arranged substantially parallelly to the support column to the second operational position.
4. Apparatus according to claim 3, wherein the pivot joint includes a resilient device biased to the second position.
5. Apparatus according to any preceding claim, and further comprising an illumination means at the top end of the support column.
6. Apparatus according to claim 5, wherein the illumination means is connected to a motion sensing device.
7. Apparatus according to any one of claims 3 to 6, and further comprising retention means for securing an end region of the arm opposite an end of the arm connected to the pivot joint when the arm is in the first sowed position.
8. Apparatus according to any preceding claim, wherein the arm is telescopic.
9. Apparatus according to any one of claims 2 to 8, wherein top end region of the expandable device when expanding contacts and centrally locates in an underside zone of a bottom end region of the first part of the support column.
10. Apparatus according to any one of claims 2 to 9, and further comprising a position sensor for detecting the position of the first part relative to the second part.
11. Apparatus according to claim 10, wherein when a set maximum is reached, the position sensor sends a shut-off signal to a fluid displacement device for expanding the expandable device to prevent any more fluid from being displaced into the expandable device.

12. Apparatus according to claim 10 or 11, wherein the position sensor is preferably a magnetic sensor.
13. Apparatus according to any preceding claim, and further comprising a user interface to operate the apparatus.
14. Apparatus according to any preceding claim, and further comprising a power supply unit from which the support column extends outwardly and upwardly.
15. Apparatus according to any one of claims 1 to 13, and further comprising a power supply unit electrically connected to a storage unit which encloses the support column and the arm in the first position.
16. A method of charging an electric vehicle, comprising moving a support column from a lower condition to a raised condition, pivoting an arm connected to the support column from a first stowed position to a second operational position, wherein the moving the support column from the lower to the raised condition includes expanding an expandable device.
17. A method according to claim 16, and further comprising prior to said moving, a user identifying themselves by way of a user interface.
18. A method according to claim 16 or 17, wherein once a user is identified and prior to said axially extending, unlocking at least the arm from retention means.
19. A method according to any one of claims 16 to 18, wherein during said pivoting, connecting a vehicle charging cable to an electric vehicle charging connection means at an end region of the arm.
20. A method according to any one of claims 16 to 19, and further comprising telescoping the arm to reach a greater distance.
21. A method according to any one of claims 16 to 20, and further comprising providing illumination from a top end region of the support column.

Intellectual Property Office

Application No:	GB2314727.5	**Examiner:**	Jonathan Marlow
Claims searched:	1-21	**Date of search:**	21 February 2024

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-21	CN 110154815 B (XIANG) Figures 1, 3 and 5.
X	1-7, 9-18, 21	CN 211641889 U (MILES NEW ENERGY TECH SHANGHAI) Figures 1 and 2.
X	1, 2, 5, 6, 10-18, 21	US 2021/0252989 A1 (PRICE et al.) Figures 1, 2, 4 and 5, and paragraph [0074].

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B60L

The following online and other databases have been used in the preparation of this search report

SEARCH-PATENT

International Classification:

Subclass	Subgroup	Valid From
B60L	0053/31	01/01/2019