(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 November 2015 (05.11.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/166405 A1

(51) International Patent Classification:
H04B 3/54 (2006.01) *H02J 13/00* (2006.01)
H05B 37/02 (2006.01)

(21) International Application Number:
PCT/IB2015/053077

(22) International Filing Date:
28 April 2015 (28.04.2015)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
BO2014A000247 30 April 2014 (30.04.2014) IT

(71) Applicant: **UMPI R&D S.R.L.** [IT/IT]; Viale Respighi, 13, I-47841 CATTOLICA (Rimini) (IT).

(72) Inventors: **MORETTI, Gianluca**; Via Sirtori, 22, I-47814 BELLARIA (Rimini) (IT). **GROSSI, Alberto**; Via Tessarini, 6, I-47923 Rimini (IT). **FACCIN, Pier**; Via Molino 8/D, I-47039 SAVIGNANO SUL RUBICONE (Forlì Cesena) (IT).

(74) Agent: **PUGGIOLI, Tommaso**; BUGNION S.p.A., Via di Corticella, 87, I-40128 Bologna (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

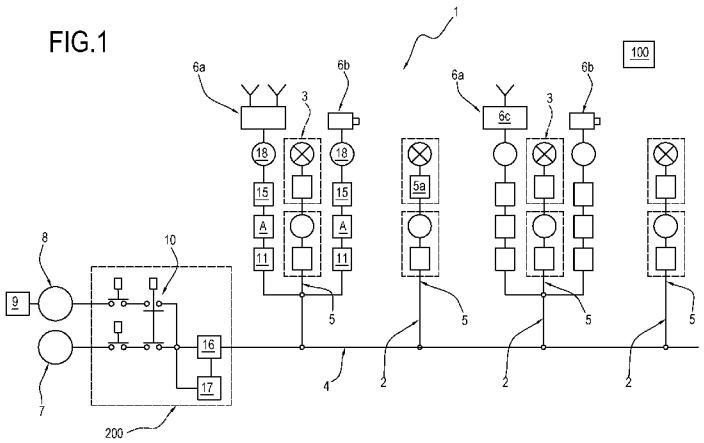
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: LIGHTING INFRASTRUCTURE AND PROCESS FOR INSTALLING THE INFRASTRUCTURE.

FIG.1



(57) Abstract: Described is an infrastructure (1) for public lighting and providing ancillary services for the lighting function comprising a power supply line (4), a plurality of poles (2), a plurality of lighting units (3) installed on the poles (2), a power supply and control system (5, 5a) between the supply line (4) and the lighting units (3), at least one device (6a, 6b) for providing ancillary services for the lighting function connected to a data transport network (100, 300) installed on a respective pole (2), a system (A, 11, 15, 18) for power supply and control of the device (6a, 6b) for providing ancillary services for the lighting function, a system (6c) for radio connection of the device, a device (6a, 6b) for providing ancillary services for the lighting function when the latter is a device (6a) for radio access to the data transport network (100); the system (A, 11, 15, 18) for power supply and control of the device (6a, 6b) for providing ancillary services comprising power line carrier coupling devices (11) for coupling the supply system (A, 11, 15, 18) with the system (5, 5a) for supplying the lighting units (3), a power supply unit (A) for supplying the device (6a, 6b) for providing ancillary services, a system (15) of acquiring at least one electrical parameter significant for the operation of the device (6a, 6b) for providing ancillary services, a microcontroller (A) in communication with the coupling devices (11), with the power supply unit (A) and with the acquisition system (15); the microcontroller (A) being programmed to control a power supply of the device (6a, 6b) for providing ancillary services and a transmission of data from and to the device (6a, 6b) for providing ancillary services for the lighting function.

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DESCRIPTION

LIGHTING INFRASTRUCTURE AND PROCESS FOR INSTALLING THE INFRASTRUCTURE

Technical field

This invention relates to a lighting infrastructure and a process for its installation. More specifically, this invention relates to an infrastructure for public lighting designed for providing ancillary services to the above-mentioned lighting function, hereinafter indicated simply as ancillary services, such as, for example, mobile voice and data connectivity provided by radio access devices, video surveillance services provided by video cameras, information services provided from multifunctional multimedia stands, and, if necessary, actuators or remote links for public utility purposes, such as movable barriers for regulating access to reserved areas, all these devices for providing services being conveniently installed on the poles of the infrastructure or in the immediate vicinity.

Usually, the public lighting infrastructures comprise a plurality of poles each carrying at least one light source, for example a lighting unit to which explicit reference will be made without thereby limiting the scope of the invention, connected to a power supply network to define, in practice, a lamp post.

Background art

In this scenario, infrastructures have been developed which use the poles of the public lighting systems to carry additional devices for ancillary services, such as remote surveillance devices or Wi-Fi access points.

A problem of such systems is in the power supply, in the management and the control of the devices installed on the pole, in particular in the case of radio access (or wireless access) devices installed on a lighting pole.

In effect, once the devices are installed on the pole they must be supplied with a suitable voltage; it must be possible to activate or deactivate the devices as required and their correct operation must be effectively monitored.

Also, in the preferred embodiment of wireless access devices they must be connected, possibly physically, to a transport network for the exchange and transmission of data.

Disclosure of the invention

One aim of this invention is to provide a lighting infrastructure designed for providing ancillary services which allows in particular the power supply and the control of radio access devices installed on the poles.

Another aim of this invention is to provide a lighting infrastructure designed for providing ancillary services which allows the connection of radio access devices installed on the poles to a transport network.

The technical purpose indicated and the aims specified are substantially achieved by a lighting infrastructure according to claim 1.

Brief description of drawings

Further features and advantages of this invention are more apparent in the detailed description below, with reference to a preferred, non-limiting embodiment of a lighting infrastructure as illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic block diagram, with some parts cut away for clarity, of the lighting infrastructure according to this invention;
- Figure 2 is a schematic block diagram of a detail of a first embodiment of the infrastructure of Figure 1;
- Figure 3 is a schematic block diagram of a detail of a second embodiment of the infrastructure of Figure 1;
- Figure 4 is a schematic block diagram, with some parts cut away for

clarity, of the lighting infrastructure according to a second embodiment of this invention;

- Figure 5 is a schematic block diagram, with some parts cut away for clarity, of the lighting infrastructure according to a third embodiment of this invention;

Detailed description of preferred embodiments of the invention

With reference in particular to Figure 1, the numeral 1 denotes a lighting infrastructure according to this invention and in particular an infrastructure for public lighting designed for providing ancillary services for the lighting function, hereinafter indicated simply as ancillary services, such as, for example, mobile voice and data connectivity provided by radio access devices, video surveillance services provided by video cameras, information services provided from multifunctional multimedia stands, and, if necessary, actuators or remote links for public utility purposes, such as movable barriers for regulating access to reserved areas, a support for a mobile communication system or for a video surveillance system, all these devices for providing services being conveniently installed on the poles of the infrastructure or in the immediate vicinity.

The infrastructure 1 comprises a plurality of poles 2 on each of which a light source 3 or lighting unit is installed, for example a discharge lamp, to which explicit reference is made, to define, in practice, lamp posts.

The infrastructure comprises a power supply line 4 to which the lighting units 3 are connected.

More specifically, the lighting units 3 are connected to the power supply line 4 by suitable power supply means.

The power supply means of the lighting units 3 comprise for example an electrical connection formed by several conductors 5, of substantially known type and, preferably, a control device, for example for monitoring faults or for remote starting, schematically represented with a block 5a and

not further described.

The infrastructure 1 comprises a plurality of devices 6a, 6b, 6c for providing the above-mentioned ancillary services.

More specifically, the infrastructure 1 comprises a plurality of radio access devices 6a, preferably LTE eNodeB devices for femto or pico radio coverage, in short, small cells, which are also fitted on the poles 2, and related power supply means and connection means to a data transport network, preferably an LTE Evolved Packet Core network, in short, core network, which is schematically represented as the block 100, as described in further detail below.

In that sense, the lighting infrastructure 1 is also designed, as will be clarified, for providing ancillary services such as the connection to a data network.

The connecting means are described and illustrated only insofar as necessary for understanding this invention.

In general, for their operation, the small cells must be connected to the core network 100 by a dedicated data connection. This is normally provided by a data connection such as xDSL, Ethernet or the like, which uses a dedicated physical carrier (copper or optical fibre).

The infrastructure 1 also or alternatively comprises devices 6b, for example, multifunctional multimedia stands, actuators or remote links for public utility purposes or video surveillance cameras, to which reference is made for simplicity, also fitted on the poles 2 or in their immediate vicinity.

The devices 6b can be supplied and controlled with the same methods described below for the devices 6a, except for the fact that they are supplied with a suitable voltage imparted by a corresponding power supply unit.

More specifically, the infrastructure 1 comprises supply means and connecting means, substantially of the type used for connecting the devices 6a, the video surveillance devices 6b to a relative data transport

network, for example an IP (Internet Protocol) network schematically represented as the block 300, as described in further detail below.

In that sense, the lighting infrastructure 1 is also designed, as will be clarified, for providing ancillary services such as, for example, a video surveillance service.

In the description below, reference will also be made in general, for simplicity, to a single device 6a meaning the devices 6a and 6b which are similar to each other in operation, in particular for the supply and for the connection to the respective data transport networks 100, 300, unless otherwise specified.

In the preferred embodiment illustrated in Figure 1, the infrastructure 1 comprises an alternating current (AC) supply circuit 7 for supplying the supply line 4. The AC power supply is preferably, in this case, 220V 50Hz single-phase and neutral.

The infrastructure 1 comprises a supply circuit 8 with a voltage lower than that of the supply circuit 7, possibly in direct current (DC), for supplying the supply line 4.

The second supply circuit 8 preferably comprises at least one emergency power supply unit 9, possibly equipped with a battery, not illustrated, having the function of backup or emergency supply of the line 4 in the event of a fault to the circuit 8.

The infrastructure 1 comprises means for selecting the AC supply circuit 7 or the supply circuit 8 with a lower voltage, possibly in DC, for supplying the supply line 4.

The possibility of selecting the supply for the line 4 makes it possible to supply, if necessary, exclusively the devices 6a; in effect, in the case of supplying at a lower voltage, if necessary in DC, the lighting units 3 preferably used do not operate.

The selecting means are inserted in an electrical panel 200 positioned upstream of the supply line 4, between the circuits 7 and 8 and the line 4.

The selecting means comprise for example a selecting device 10, such as a switch, preferably which can be controlled remotely, which is able to connect alternatively the supply line 4 with the circuit 7 or with the supply circuit 8.

In a preferred embodiment of the infrastructure 1, the radio access devices 6a are of the so-called small cell type, of substantially known type not described in detail, to which reference is hereinafter made without in any way restricting the scope of the invention.

In general, the infrastructure 1 is preferably designed for small cells and LTE (Long Term Evolution) technology. In other embodiments, instead of the small cells for radio access there are the so-called active antennas (Active Antenna System, AAS), possibly multi-standard, remote antennas (possibly multi-standard, multi-band and multi-operator) belonging to distributed antenna systems (DAS), or Wi-Fi Hot Spots, since all these, in final analysis, are means for achieving radio access to a transport network.

In a further embodiment of the invention, at least one lamp post will be used as a site for locating an LTE Wi-Fi Hot Spot apparatus, that is, a Wi-Fi device with wireless LTE data connection (or, possibly, 3G) which will be powered, for example with 12V DC, with the manner described.

Looking in more detail at the above-mentioned supply means of the device 6a, these comprise power line carrier coupling means (that is, coupling means which allow a data connection using Power Line Communication, PLC, technology) for coupling the supply means of the device 6a with the supply means of the lighting units 3.

In practice, the supply of the device 6a is derived from the supply of the lighting unit 3.

Moreover, since there are power line carrier coupling means, it is possible to transfer data in a two-way manner using the supply line 4.

As illustrated for example in Figures 2 and 3, the power line carrier coupling means comprise a PLC coupler 11, connected to the supply line

4, coupled to a PLC Modem module 12 of substantially known type.

The supply means comprise a power supply unit 13 connected to the coupling means, in particular with the PLC coupler 11, from which it receives the supply of the line 4, after filtering by the modulation performed by the PLC Modem module 12, and lastly with the device 6a.

In the preferred embodiment wherein the device 6a comprises a small cell, according to the embodiment of Figure 2, the power supply unit 13 is configured to supply to the device 6a, for example, a supply voltage of -48V DC.

The supply means comprise a microcontroller 14 in communication with the power supply unit 13 and with the power line carrier coupling means, in particular with the PLC Modem module 12.

The supply means comprise a device 24, of substantially known type, for acquisition of the electrical parameters which uniquely characterise the features of the supply voltage present on the supply line 4.

The microcontroller 14 is in communication with the device 24 and is also configured to control the power supply unit 13 in such a way that provides a power supply to the device 6a adapting it to the voltage level present on the line 4 by means of the direct measurement made by the device 24.

The components 12, 13, 14 and 24, forming part of the supply line of the device 6a are grouped together, for simplicity, in a block A in Figures 1, 4 and 5.

Figures 2 and 3 illustrate preferred embodiments of the circuit in the block A.

The supply means comprise means, schematically represented as a block 15, for acquisition of at least one electrical parameter, for example voltage and/or current, representing the operation of the radio access device 6a.

The acquisition means 15 operate between the power supply unit 13 and the radio access device 6a.

The microcontroller 14 is programmed to control the power supply of the radio access device 6a and to control the PLC Modem module 12, the latter being in communication with the panel 200. The data acquired by the device 15 representing the operation of the radio access device 6a is sent to the panel 200, the data being processed by the microcontroller 14 and supplied to the PLC Modem module 12 for transmission along the line 4.

Preferably, for controlling the small cells the PLC technology used is that of the so-called "Narrow Band PLC" type which allows a slow speed data transmission, in the order of a few kb/s. The above-mentioned panel 200 is configured, as well as for supplying the line 4, for controlling the radio access device 6a using power line carrier technology.

The panel 200 comprises second power line carrier coupling means positioned, in practice, along the supply line 4.

As illustrated, for example in Figure 1, the power line carrier coupling means positioned in the panel 200 comprise a PLC coupler 16 inserted along the line 4 and a PLC Modem module 17, of substantially known type, inserted between the line 4 and the power supply conductors 5 of the lighting units 3.

In the preferred embodiment illustrated, the infrastructure 1 comprises a controlled switch 18 operating between the power supply 13 and the radio access device 6a.

More specifically, the switch is positioned between the acquisition means 15 and the radio access device 6a.

THE infrastructure 1 allows remote control of the operation of the device 6a, in particular of the small cell, for example from the panel 200, by means of the power line communication technology.

Similarly, the infrastructure 1 allows remote control of the operation of the device 6b, in particular a video surveillance device, for example from the panel 200, by means of the power line communication technology.

The infrastructure 1 also allows, preferably, the switching on and the

switching off of the device 6a by the switch 18 controlled using the power line communication technology.

With reference to Figure 3, in the preferred embodiment illustrated, wherein the connection of the device 6a to the core network is made by means of cable, the supply of the radio access device 6a, in particular the small cell, occurs using IEEE Power over Ethernet + technology.

The infrastructure 1, in particular the means for connecting the device 6a to the core network 100 comprises a cable 19, in particular an Ethernet cable of the IEEE Power over Ethernet Plus type, that is, PoE+, as output from the device 6a.

The supply means of the device 6a comprise an interface 20, in communication with the microcontroller 14, operating between the power line carrier coupling means for coupling the supply means of the device 6a with the supply means of the lighting units 3 and the cable 19.

The infrastructure 1 comprises an Ethernet cable 21 for connecting the small cell to the core network for transmitting data.

Looking in more detail at the interface 20, it should be noted that it comprises a module 22, mainly having PoE Injector functions, of substantially known type, in communication with the microcontroller 14, and a power supply unit 23, which is also in communication with the microcontroller 14, and connected to the coupling means, in particular with the PLC coupler 11, from which it receives the power supply of the line 4.

Preferably, the module 22 integrates the means for acquiring at least one electrical parameter, for example voltage and/or current, representing the operation of the radio access device 6a and the switch 18, that is, it allows the remote switching on and switching off of the device 6a and monitoring its operation.

It should be noted that the microcontroller 14, in communication with the device 24, is configured to control the power supply unit 23 in such a way that provides a power supply to the device 6a adapting it to the voltage

level present on the line 4 by means of the direct measurement made by the device 24. The microcontroller 14 is in communication with the PLC Modem module 12 to which the data acquired by the device 22 representing the operation of the radio access device 6a is sent, the data being processed by the same microcontroller 14.

With reference to Figure 1, it should be noted that on a pole 2, the radio access device 6a is defined by a wireless backhaul device 6c of substantially known type for connecting the small cells 6a to the core network 100 by a radio bridge.

The device 6c is supplied as described in general for the devices 6a and can therefore be controlled remotely using power line carrier technology along the supply line 4.

Figures 4 and 5 are, respectively, a second and a third embodiment of an infrastructure 1 according to this invention.

The supply line 4 is represented here with a three-phase and neutral type line and the above-mentioned means of connecting the radio access device 6a comprise a network cable 26, for example an Ethernet cable from the device 6a.

The above-mentioned AC supply circuit 7 means, in this case, 380V 50Hz three-phase and neutral.

The connecting means comprise a Broadband over Powerline BPL coupling device 27, of the SISO type (Single Input Single Output) or, possibly, of the MIMO type (Multiple Input Multiple Output), operating between the network cable 26 and the supply line 4.

The device 27 incorporates a BPL Modem, for example of the MIMO type, and a three-phase line coupler, both of which are neither illustrated nor described.

Similarly, the panel 200 comprises a BPL coupling device, possibly of the MIMO type, preferably formed by a three-phase MIMO BPL line coupler 28 and by a MIMO BPL Modem 29 by which the panel 200 and the line 4 are

in data communication with the network 100.

As shown in Figure 4, the device 6b, for example a video surveillance device, is connected to the network 4 by means of a network cable 30, for example an Ethernet cable, and coupled to it by a corresponding BPL type coupling device 31, possibly of the MIMO type, operating between the network cable 30 and the supply line 4.

The device 31 incorporates a MIMO BPL Modem and a three-phase line coupler, both of which are neither illustrated nor described.

Using this connection the data acquired by the video surveillance device 6b is transmitted to the line 4 and from there to the relative data transport network 300.

The above-mentioned Modem 29, incorporates the necessary data multiplexing and demultiplexing functions in order to separate the data flows from and to the transport network 100 from those from and to the transport network 300.

With reference to Figure 5, the data transmission to the wireless backhaul device 6c occurs by a network cable 32, for example an Ethernet cable, coupled to the line 4 by means of a corresponding MIMO BPL type coupling device 33 operating between the network cable 32 and the supply line 4.

In this configuration, relative to that of Figure 4, the data connection with the network 100 does not take place from the panel by means of a cable but by a radio bridge thanks to the wireless backhaul device 6c.

The infrastructure 1 in the embodiments of Figures 4 and 5 uses the BPL technology, which belongs to the PLC technology family, to connect the small cells to the core network, in this instance re-using the cables powering the lamp posts.

In one embodiment, the general electrical panel of the infrastructure is connected to the core network through a dedicated data connection on a physical carrier.

From the general electrical panel, with suitable conversion interfaces equipped with BPL Modems, the data flow can reach each small cell from and to the core network 100.

Similarly, from the general electrical panel, with suitable conversion interfaces equipped with BPL Modems, the respective data flows from and to the transport network 300 can be received by each video surveillance device 6b.

An evident advantage is the re-use of the existing physical infrastructure which means it is not necessary to specifically wire the lamp post on which the small cell or the video surveillance device has been installed.

In the embodiment of Figure 5, the BPL technology is used for connecting together the wireless backhaul apparatus with the small cell(s).

In an embodiment not illustrated, the wireless backhaul apparatus is located in the panel 200 or close to it but connected to it.

In the embodiment illustrated, the wireless backhaul apparatus is preferably located on a lamp post.

In other words, the infrastructure 1 allows the small cells to be connected to the core network when these are suitably positioned on public lighting poles using the power supply line which is already present and BPL technology.

In a further embodiment of this invention, the wireless backhaul apparatus is connected to the small cells using the power supply line of the lamp post and BPL technology.

The small cells are connected to the wireless backhaul device by BPL, that is to say, using the copper electricity supply connections without making further connections.

THE infrastructure 1 is preferably intended for small cells and LTE technology.

In alternative embodiments the infrastructure 1 comprises Wi-Fi Hot Spots or active antennas (possibly multi-standard) of the AAS type or remote

antennas (possibly multi-standard, multi-band and multi-operator) belonging to the DAS family, the latter possibly, but without limiting the invention, equipped with xDSL, Ethernet, CIPRI, OBSAI and other interfaces.

The embodiment illustrated in Figures 4 and 5 lends itself to being used effectively to provide connectivity to video surveillance cameras 6b, to multifunctional multimedia stands, to actuators or remote links for public utility purposes, these parts being omitted for greater clarity, with the same methods of re-use of the power supply line.

In general, the presence of the power supply circuits 7 and 8 allows the power supply of the small cells when the lighting units 3 are switched off using both the electricity supply line to which the lamp post is connected, and the control devices 5a which preferably allow the switching on of the lighting units.

More specifically, it is possible, for example, to leave the line 4 powered at 220V AC during the daytime hours switching off each individual lighting unit 3 with a dusk/dawn switch, that is to say, leaving the line 4 powered at 220V AC during the daytime hours switching off each individual lighting unit 3 with the device 5a controlled remotely, preferably, but not necessarily, via PLC.

If it is not possible to leave the line powered at 220V AC during the daytime hours, secondary supply circuit 8 may be used which supplies the line 4 preferably at a lower voltage and preferably, but not necessarily, in DC.

Operation of the small cells over 24 hours is guaranteed by the presence of the emergency power supply unit 9.

This invention also relates to a process for installing a lighting infrastructure.

More specifically, the installation process according to this invention allows the installation of the devices 6a, 6b, 6c for providing ancillary services, in

particular of a radio access device 6a, to which explicit reference will be made without thereby limiting the scope of the invention, in an existing lighting system at the same time providing a system for supplying the devices 6a, 6b, 6c and a system for controlling the devices.

Given a lighting infrastructure comprising the poles 2, the lighting units 3, the power supply line 4 and the panel 200 for supplying the line 4, the process comprises a step of installing a radio access device 6a, in particular a small cell on at least one pole.

The process comprises a step of preparing power supply means for the device 6a.

The power line carrier coupling means are integrated in the supply means of the device 6a for coupling the supply means of the device 6a with the supply means of the lighting units 3.

In practice, the supply of the device 6a is derived from the supply of the lighting unit 3.

In other words, once the device 6a is installed on the respective pole 2, it is supplied by a power supply system derived from the supply of the corresponding lamp.

A power line carrier communication system for controlling the device 6a, comprising, for example, the above-mentioned block A, is integrated with the supply system and a respective control panel, comprising, for example, the PLC coupler 16 and the PLC Modem module 17, set up in the panel 200 for supplying the supply line 4.

In one embodiment, the installation process comprises preparing a data connection of the device 6a to the core network 100 in the substantially known way, for example by means of suitable network cables and interfaces.

Similarly, if the device for providing ancillary services is a video surveillance device 6b, the installation process comprises preparing a two-way data connection from the device 6b to the network 300.

In a preferred embodiment, the data connection of the remote device 6a to the data transport network 100 is performed using PLC technology.

In practice, the coupling device 26, for example of the PLC MIMO type, is inserted and configured between the network cable 26 at the output from the device 6a and the supply line 4 of which the three phases and neutral are used.

The panel 200 is integrated with the corresponding coupling device, for example of the MIMO type, preferably formed by the three-phase MIMO PLC line coupler 28 and by the MIMO PLC Modem 29 by which the panel 200 and the line 4 are in data communication with the network 100.

In this way, a generic telephone operator arrives with a data connection at the panel 200, that is, at the supply line of the lamp posts then, using the suitable above-mentioned interfaces, the data connection with the small cells is carried out by means of the power supply cables using PLC technology.

Advantageously, the process as described herein makes it possible to use the existing infrastructures for implementing a data transport or transmission network.

A generic public lighting system is used in particular for the installation of mobile communication antennas or video surveillance devices.

By using the existing poles it is possible to maximise the capacity of the mobile communication system using to the maximum extent each radio channel with the maximum possible number of antennas or radio access devices so as to increase, at a lower overall cost, the number of users which can be served per surface unit.

The small cells make it possible to improve the radio coverage in zones with a high density of users, such as, for example, conference centres, shopping centres, stadiums, railways or town centres where a coverage based on femtocells or picocells, rather than macrocells, is preferable.

In the preferred case in which both the control and the data connection of

the radio access devices 6a occurs using PLC technology and the power supply system of the existing lighting units, integrated in them, the infrastructure and the installation process maximise the use of already existing resources.

CLAIMS

1. A lighting infrastructure comprising
a power supply line (4),
at least one pole (2),
at least one light source (3) fitted on the pole (2),
first power supply means (5, 5a) operating between the light source (3) and the power supply line (4),
at least one device (6a, 6b, 6c) for providing ancillary services installed on the pole (2),
second means (A, 11, 15, 18) for power supply to the device (6a, 6b, 6c) for providing ancillary services,
means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) of connecting the device for providing ancillary services to a data transport network (100, 300), the infrastructure being characterised in that
the second power supply means (A, 11, 15, 18) comprise
first power line carrier coupling means (11, 12) for coupling the second power supply means (A, 11, 15, 18) with at least the first power supply means (5, 5a);
a supply unit (13, 23) in communication with the first coupling means (11, 12) and the device (6a, 6b, 6c) for providing ancillary services for supplying the device (6a, 6b, 6c) for providing ancillary services with a predetermined voltage,
means (15, 22) of acquiring at least one electrical parameter significant for the operation of the device (6a, 6b, 6c) for providing ancillary services operating between the supply unit (13, 23) and the device (6a, 6b, 6c) for providing ancillary services,
the second supply means (A, 11, 15, 18) comprising a microcontroller (14) in communication with the first coupling means (11, 12), with the power supply unit (13, 23) and with the acquisition means (15, 22), the microcontroller (14) being programmed to control at least one supply of the

device (6a, 6b, 6c) for providing ancillary services and a transmission of data from and/or to the device (6a, 6b, 6c) for providing ancillary services, the infrastructure comprising a control panel (200) and second power line carrier coupling means (16, 17) positioned along the supply line (4) between the control panel (200) and the pole (2), the microcontroller (14) being configured for controlling the first coupling means (11, 12), the first coupling means (11, 12) being in communication with the control panel (200) to which data acquired from the acquisition means (15, 22) is sent representing the operation of the device (6a, 6b, 6c) for providing ancillary services.

2. The infrastructure according to claim 1, wherein the device (6a, 6b, 6c) for providing ancillary services comprises a wireless access device (6a).

3. The infrastructure according to claim 1 or 2, wherein the device (6a, 6b, 6c) for providing ancillary services comprises a video surveillance device (6b).

4. The infrastructure according to any one of the preceding claims, wherein the device (6a, 6b, 6c) for providing ancillary services comprises multifunctional multimedia stands or actuators or remote links for public utility purposes.

5. The infrastructure according to any one of the preceding claims, wherein the device (6a, 6b, 6c) for providing ancillary services comprises a wireless access device (6a) and is defined by a small cell.

6. The infrastructure according to any one of the preceding claims, wherein the device (6a, 6b, 6c) for providing ancillary services comprises a wireless access device (6a) and is defined by an AAS active antenna.

7. The infrastructure according to any one of the preceding claims, wherein the device (6a, 6b, 6c) for providing ancillary services comprises a wireless access device (6a) and is defined by a remote antenna forming part of a system of distributed antennas.

8. The infrastructure according to any one of claims 1 to 7, wherein the second power supply means (A, 11, 15, 18) comprise a controlled switch

(18) operating between the supply unit (13, 23) and the device (6a, 6b, 6c) for providing ancillary services.

9. The infrastructure according to claim 8, wherein the switch (18) is positioned between the acquisition means (15, 22) and the device (6a, 6b, 6c) for providing ancillary services.

10. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise at least one network cable (19), the second supply means (A, 11, 15, 18) comprising an interface (20) between the first coupling means (11, 12) and the network cable (19) in communication with the microcontroller (14).

11. The infrastructure according to claim 10, wherein the network cable (19) is an Ethernet cable which powers the device (6a, 6b, 6c) for providing ancillary services using the IEEE Power over Ethernet Plus standard.

12. The infrastructure according to claim 10 or 11, wherein the interface (20) comprises the acquisition means (22).

13. The infrastructure according to any one of claims 10 to 12, wherein the interface comprises a module (22) with Power over Ethernet Injector functionality.

14. The infrastructure according to any one of claims 10 to 13, wherein the second power supply means (A, 11, 15, 18) comprise a controlled switch (22) operating between the supply unit (23) and the device (6a, 6b, 6c) for providing ancillary services, the interface (20) comprising the controlled switch (22).

15. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise a physical carrier.

16. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise a wireless carrier.

17. The infrastructure according to any one of the preceding claims, comprising a first circuit (7) for AC supply of the supply line (4) and a second circuit (8) for supply at a lower voltage relative to the supply voltage of the first supply circuit (7) for supply of the supply line (4), the infrastructure comprising a device (10) for selecting the first supply circuit (7) or the second supply circuit (8) for supplying the supply line (4), the second supply circuit (8) comprising at least one emergency power supply unit (9).

18. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise a *wireless backhaul* device (6c), the infrastructure comprising a second pole for supporting the *wireless backhaul* device (6c), the *wireless backhaul* device (6c) defining on the second pole the device (6a, 6b, 6c) for providing ancillary services, the second supply means (A, 11, 15, 18) powering the *wireless backhaul* device (6c) on the second pole.

19. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise a first coupling device (27) of the Broadband PLC type, in particular MIMO PLC, operating between the device (6a, 6b, 6c) for providing ancillary services and the supply line (4), the control panel (200) comprising a second coupling device (28, 29) of the Broadband PLC type, in particular MIMO PLC, operating between the supply line (4) and the data transport network (100, 300), a connection of the device (6a, 6b, 6c) for providing ancillary services and the data transport network occurring by a connection of the Broadband PLC type, in particular MIMO PLC, the supply line (4) being of the three-phase type with neutral.

20. The infrastructure according to any one of the preceding claims, wherein the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprise a *wireless backhaul* device (6c), the infrastructure comprising a second pole for supporting the *wireless backhaul* device (6c),

the connection means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) comprising

a first coupling device (27) of the Broadband PLC type, in particular MIMO PLC, operating between the device (6a, 6b, 6c) for providing ancillary services and the supply line (4),

a second coupling device (33) of the Broadband PLC type, in particular MIMO PLC, operating between the *wireless backhaul* device (6c) and the supply line (4), a connection of the device (6a, 6b, 6c) for providing ancillary services and the *wireless backhaul* device (6c) occurring by a connection of the Broadband PLC type, in particular MIMO PLC, the supply line (4) being of the three-phase type with neutral.

21. A process for installing a lighting infrastructure designed for providing ancillary services comprising

a power supply line (4),

a panel (200) for controlling the supply line (4)

at least one pole (2),

at least one light source (3) fitted on the pole,

first power supply means (5, 5a) operating between the light source (3) and the power supply line (4), the process characterised in that it comprises

a step of installing a device (6a, 6b, 6c) for providing ancillary services on the pole (2);

a step of preparing a supply system (A, 11, 15, 18) for the device (6a, 6b, 6c) for providing ancillary services;

a step of integrating in the supply system (A, 11, 15, 18) a power line carrier communication system (A, 11, 15, 18);

a step of preparing in the control panel (200) a panel (16, 17, 28, 29) for controlling the power line carrier communication system (A, 11, 15, 18);

a step of preparing means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) of connecting the device (6a, 6b, 6c) for providing ancillary services to a data transport network (100, 300).

22. The process according to claim 21, wherein the step of preparing means (6c, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33) of connecting the device (6a, 6b, 6c) for providing ancillary services to a data transport network (100, 300) comprises

a step of inserting a first coupling device (27, 32) of the Broadband PLC type, in particular MIMO PLC, operating between the device (6a, 6b, 6c) for providing ancillary services and the supply line (4),

a step of preparing a panel for controlling the infrastructure comprising a second coupling device (28, 29) of the Broadband PLC type, in particular MIMO PLC, operating between the supply line (4) and the data transport network (100, 300), a connection of the device (6a, 6b, 6c) for providing ancillary services and the data transport network (100, 300) occurring by a connection of the Broadband PLC type, in particular MIMO PLC, the supply line (4) being of the three-phase type with neutral.

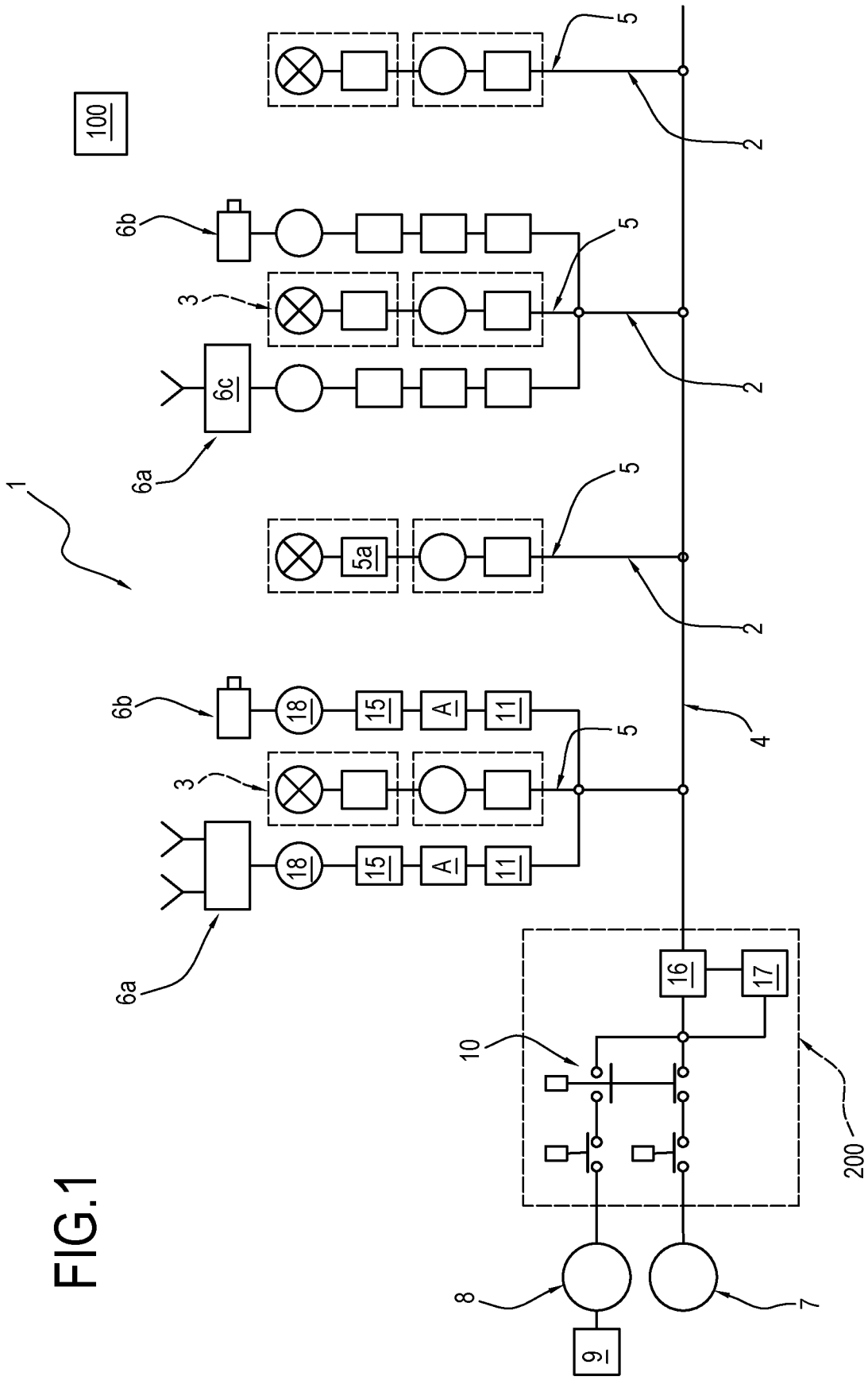


FIG.1

FIG.2

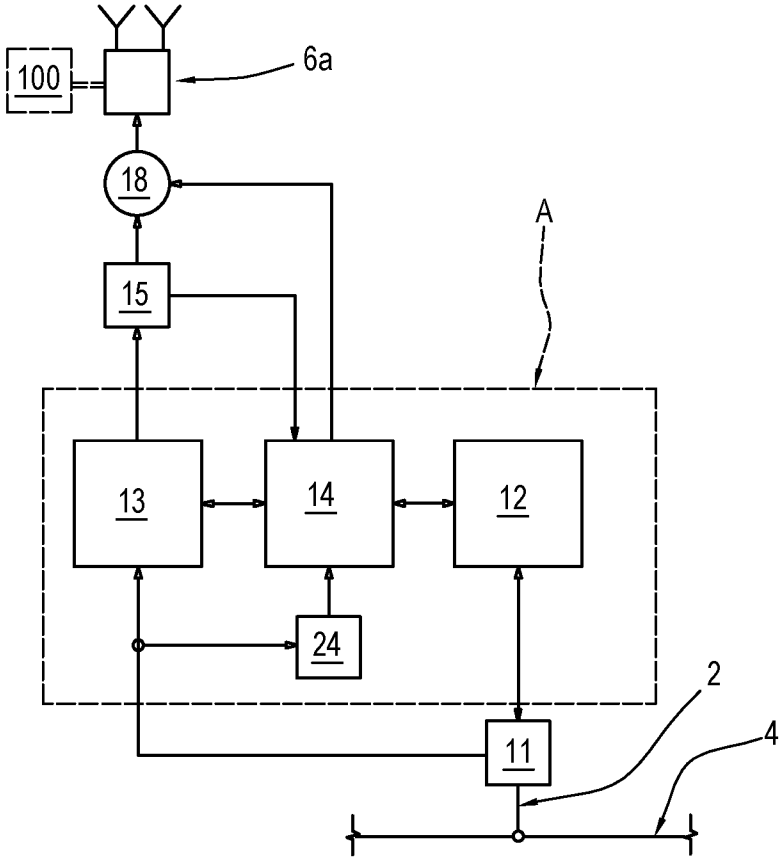


FIG.3

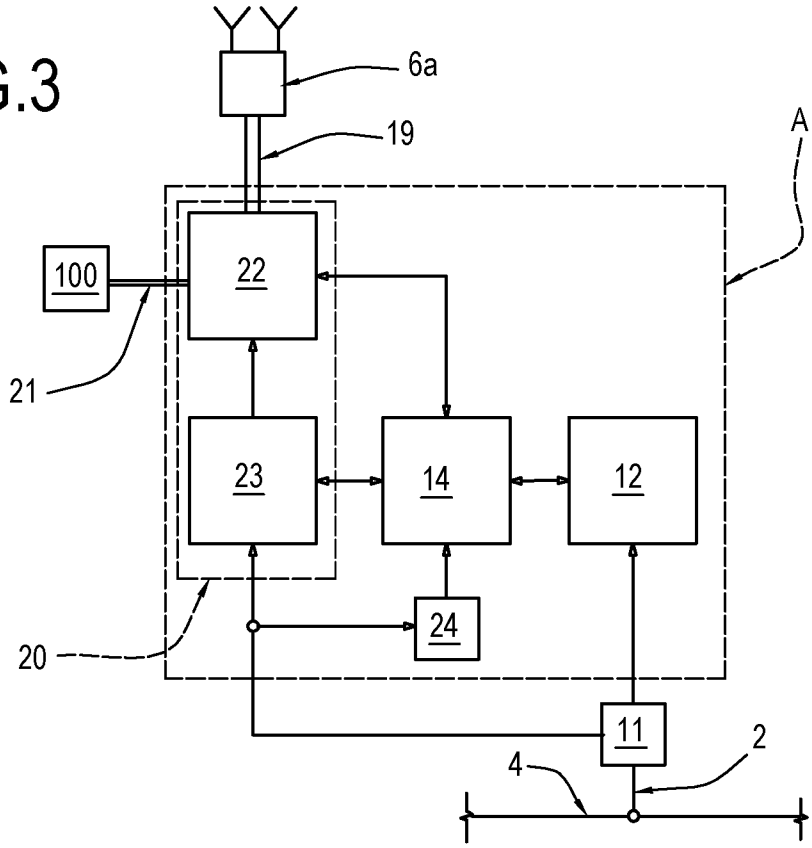
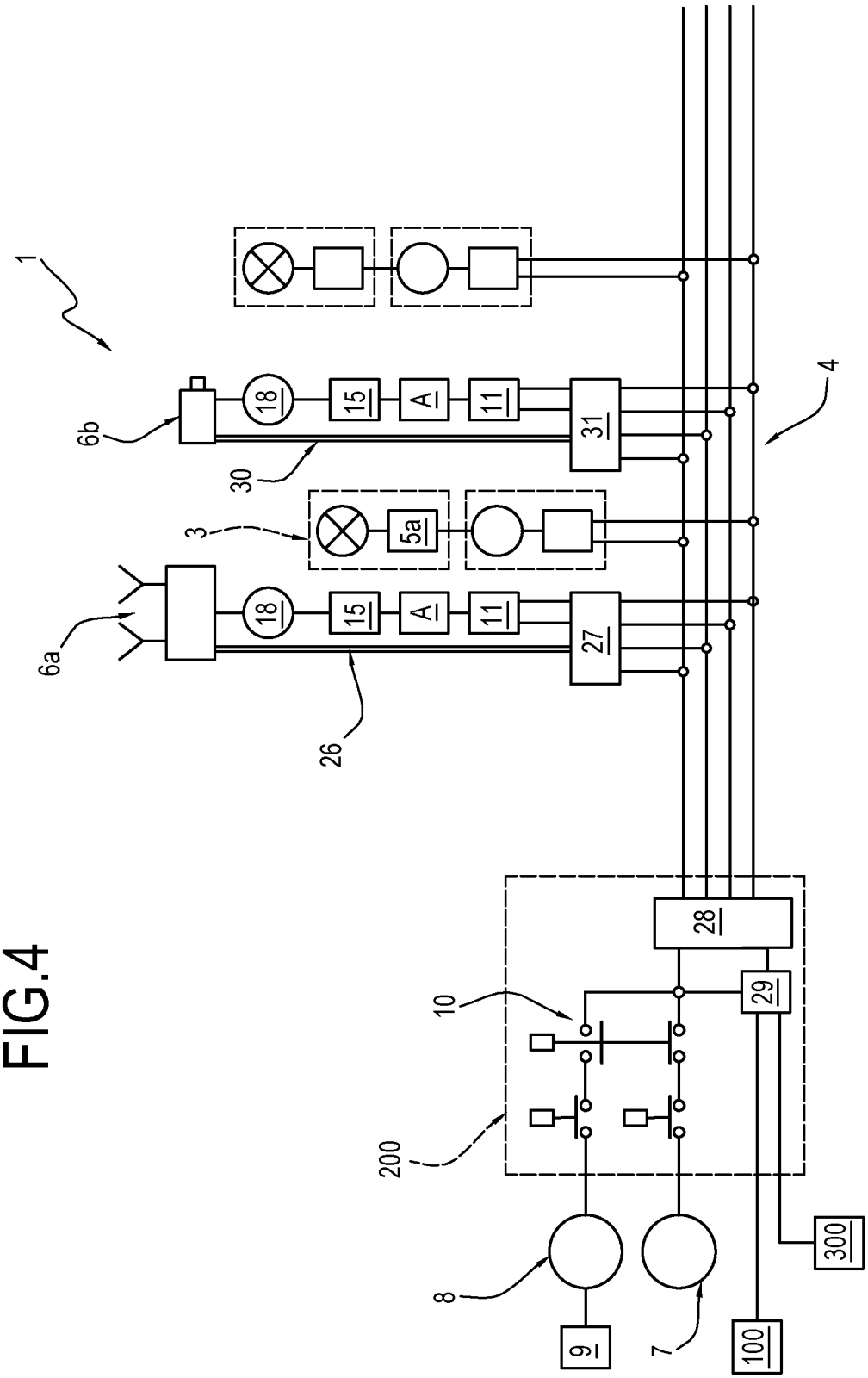


FIG.4



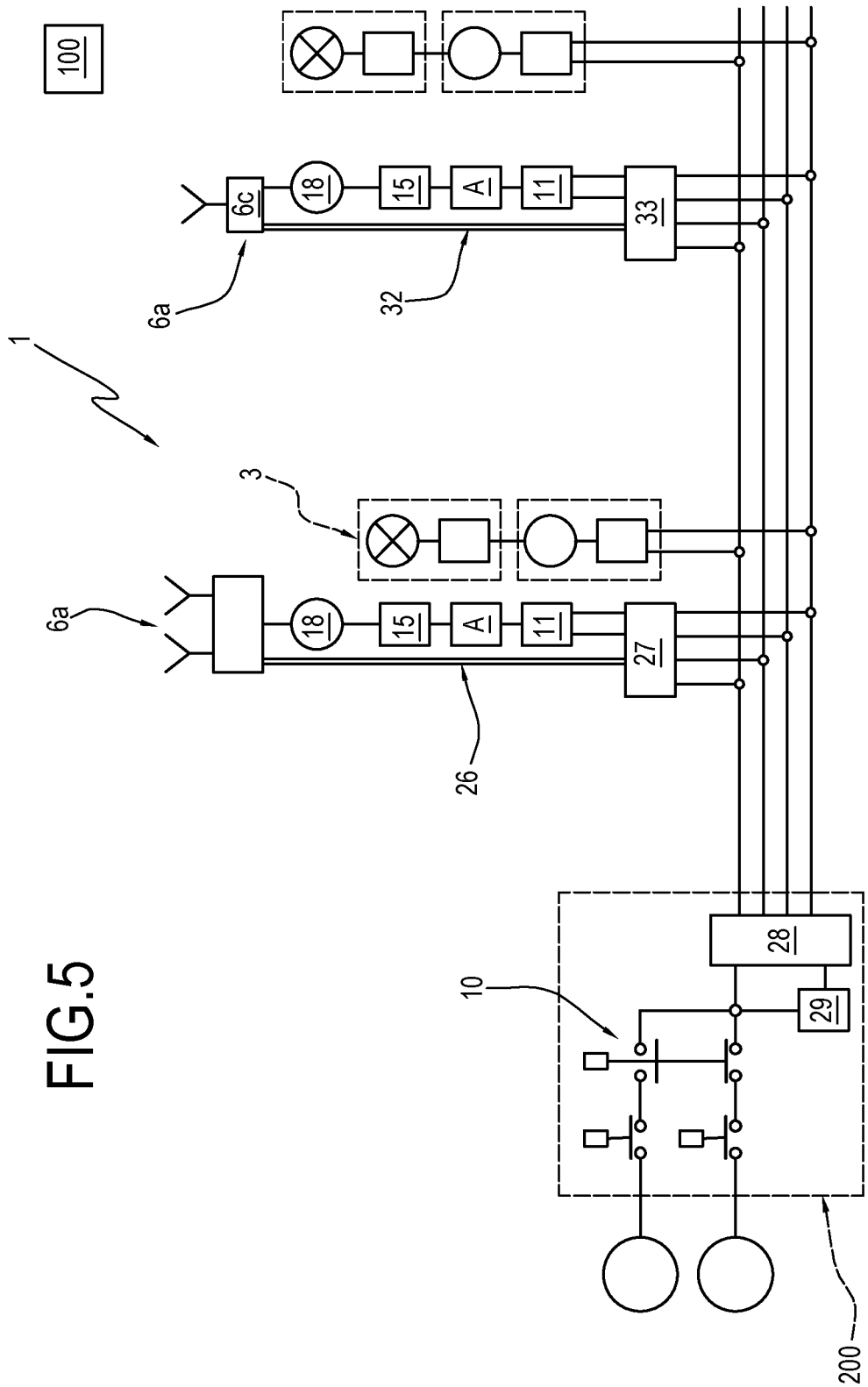


FIG.5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/053077

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04B3/54
ADD. H05B37/02 H02J13/00

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)
H04B H05B H02J

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, 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	DE 103 51 431 A1 (LEHMANN MARIO [DE]) 16 June 2005 (2005-06-16) abstract paragraphs [0002], [0006] - [0016], [0019], [0020], [0023] - [0028], [0033] - [0035], [0042], [0048] - [0051]	1-22
A	WO 2004/049585 A1 (ISKRAEMECO ECL LTD [GB]; BEATTIE ERIC [GB]; JAMNIK PAVEL [SI]) 10 June 2004 (2004-06-10) the whole document	1-22
A	FR 2 606 234 A1 (NIPPON DENKI HOME ELECTRONICS [JP]) 6 May 1988 (1988-05-06) the whole document	1-22

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 July 2015	29/07/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ricciardi, Maurizio

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/053077

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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