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(54) **CEILING SYSTEM**

(57) The present invention relates to a ceiling system (100). The system (100) includes a supporting structure (102) having a plurality of main runners (104a-e) made of an electrically conductive material. The main runners (104a-e) are arranged such that a first space (106) is formed between at least one main runner (104b) and a first adjacent main runner (104a) and a second space (108) is formed between the at least one main runner (104b) and a second adjacent main runner (104c). An electric device (110, 110a, 112) is supported by the main runners (104a-e) and is arranged in the first (106) or second space (108). A power source is (114) arranged to apply an electric voltage (V) between the main runners (104a-e). The electric device (110, 110a, 112) comprises connectors (116, 118) being in electric contact with the main runners (104a-e) such that the electric device (110, 112) is powered by the applied electric voltage (V).

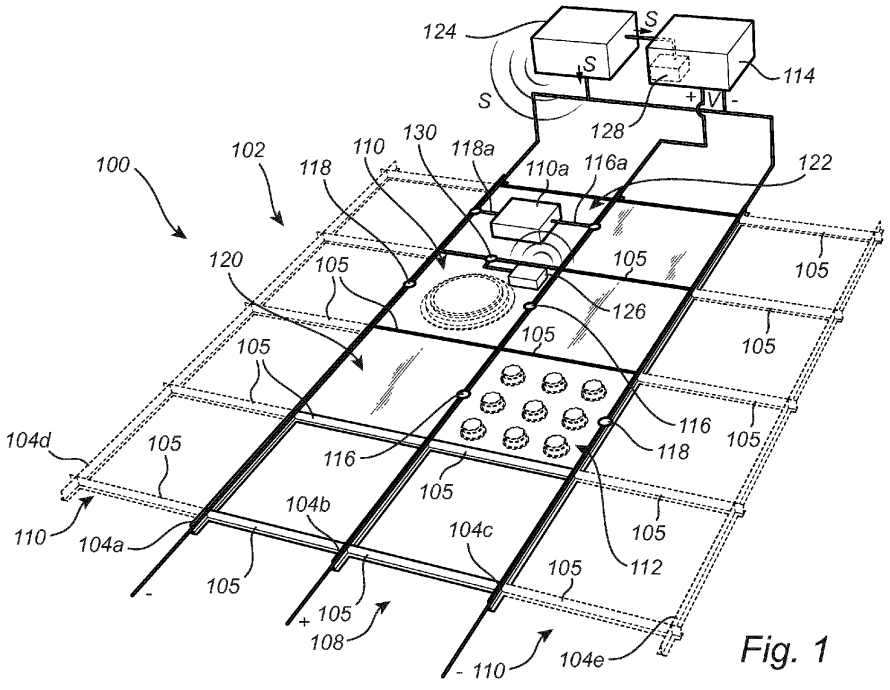

Fig. 1

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Description

Filed of the Invention

[0001] The present invention generally relates to a ceiling system comprising a supporting structure comprising a plurality of main runners made of an electrically conductive material and an electric device supported by the main runners.

Background of the Invention

[0002] A suspended ceiling system in a room or in another accommodation may serve a variety of purposes. One purpose of having a suspended ceiling system may be to conceal an underside of a space, such as another room, which is located above the room. Another purpose may be to provide improved noise absorption and/or noise attenuation in and outside of the room. The resulting plenum space located between the suspended ceiling and a main ceiling of the room may further be utilized to accommodate e.g. wiring, piping, as well as devices related to heating, ventilation and air condition.

[0003] Typically, the suspended ceiling consists of a plurality of ceiling tiles which are fitted into a supporting grid of profiles which is mounted in the main ceiling. The grid of profiles typically comprises main runners and cross runners connected thereto at right angles. The ceiling tiles are consequently typically supported by the main runners and cross runners connected thereto.

[0004] In order to furnish other objects than just pure ceiling tiles in suspended ceilings the ceiling tiles generally has to be modified so as to hold and carry the other objects concerned. This is a time consuming process prone to errors and undesired irregularities.

[0005] Further, if power consuming objects, such as lights, are to be introduced in a suspending ceiling, significant work labour will additionally have to be spent on preparing and connecting suitable wirings for the objects concerned.

[0006] In order to furnish power consuming objects in suspended ceilings it is for instance known form US 2006/0272256 to provide runners of a supporting grid with electrical wirings or rails running along some of the runners. This in order to allow for attachment of power consuming objects to the runners having the electrical wirings or rails. This approach requires significantly more complicated and expensive runners which also are more complicated to install as compared to regular suspended ceilings.

[0007] Another approach when it comes to introducing power consuming objects to a suspended ceiling is to provide dedicated spaces for the power consuming objects between dedicated current carrying rails arranged in the suspended ceiling. This approach is however time consuming, expensive and does significantly hamper the flexibility when it comes to positioning the power consuming objects in the suspended ceiling.

Summary of the Invention

[0008] In view of the above, the object of the present invention is to provide an improved ceiling system.

[0009] A further object is to provide such a ceiling system which is less time consuming to install and which is less prone to installation errors, even though comprising an electric device or a plurality of electric devices.

[0010] It is also an object to provide a more versatile ceiling system allowing a greater flexibility when it comes to providing and positioning electric devices in the ceiling.

[0011] It is also an object to provide a cost effective ceiling system requiring no or very little excess material.

[0012] To achieve at least one of the above objects and also other objects that will be evident from the following description, a ceiling system having the features defined in claim 1, is provided according to the present invention. Preferred embodiments will be evident from the dependent claims.

[0013] More specifically, there is provided according to the present invention a ceiling system comprising; a supporting structure comprising a plurality of main runners made of an electrically conductive material and extending side by side, wherein at least one of the plurality of main runners has a first adjacent main runner arranged on a first side and a second adjacent main runner arranged on a second side such that a first space is formed between the at least one main runner and the first adjacent main runner and a second space is formed between the at least one main runner and the second adjacent main runner, an electric device supported by said at least one main runner and the first or second adjacent main runner, and arranged in the first or second space formed there between; and a power source arranged to apply an electric voltage between the at least one main runner and the first and second adjacent main runner, respectively, and wherein the electric device comprising connectors being in electric contact with said at least one main runner and the associated first or second adjacent main runner such that the electric device is powered by the applied electric voltage.

[0014] Hereby an improved ceiling system is provided.

[0015] The ceiling system comprises a supporting structure comprising a plurality of main runners made of an electrically conductive material which are extending side by side. At least one of the plurality of main runners has a first adjacent main runner arranged on a first side and a second adjacent main runner arranged on a second side. Hence, at least one of the plurality of main runners is at least partially surrounded by adjacent main runners on each side. In this way a first space is formed between the at least one main runner and the first adjacent main runner and a second space is formed between the at least one main runner and the second adjacent main runner.

[0016] The main runners may be attached directly to a structural ceiling or may be suspended below at a distance from the structural ceiling as is known in the art.

Some runners may be attached to a wall or another vertical object, e.g. when the suspended ceiling connects to a wall or a column. Those runners may also be referred to as edge profiles or edge runners.

[0017] The ceiling system further comprises an electric device supported by the at least one main runner and the first or second adjacent main runner, and arranged in the first or second space formed there between.

[0018] It should be noted that within the context of this application the term "electric device" may be any type of element which may be powered or partially powered by electrical energy supplied in form of an electrical current in any suitable form.

[0019] The electric device may be directly or indirectly supported by the at least one main runner and the first or second adjacent main runner. This means in practice that the electrical device may be in physical contact with the at least one main runner and the first or second adjacent main runner or may be supported by another or a plurality of other objects being supported by the at least one main runner and the first or second adjacent main runner.

[0020] The ceiling system further comprises a power source arranged to apply an electric voltage between the at least one main runner and the first and second adjacent main runner, respectively. By this arrangement a potential difference is applied between the at least one main runner and the first and second adjacent main runner, respectively.

[0021] It should be noted that within the context of this application the term "electric voltage" may be any type of electric voltage. Hence, the electric voltage may come in any form such as a direct voltage, an alternating voltage, a modulated voltage or an intermittent voltage to mention a few nonlimiting examples.

[0022] The electric device comprises connectors being in electric contact with said at least one main runner and the associated first or second adjacent main runner such that the electric device is powered by the applied electric voltage. In this way the electric device is powered by the voltage applied between the at least one main runner and the first and second adjacent main runner, respectively.

[0023] It should be noted that within the context of this application the term "connectors" may be any type of connectors capable of providing an electrical contact between the electrical device and its associated main runners. The connectors may protrude directly from the electric device or may be arranged at a conductive element such as a wire or bar. The connectors may be partially recessed in the electrical device. The connectors may be spring loaded in order to provide a reliable electric contact.

[0024] This arrangement allows for that no additional wirings are needed since the main runners made of an electrically conductive material are used for providing a voltage to the electric device and consequently for providing energy to power the electric device.

[0025] This arrangement allows for an excellent flexibility where electric devices may be positioned freely between the main runners.

[0026] Moreover, the arrangement allows for that electric devices may be positioned at all locations of a suspended ceiling.

[0027] The supporting structure may further comprise cross runners interconnecting the plurality of main runners extending side by side. By utilizing cross runners interconnecting the plurality of main runners the main runners may be stabilized and less prone to run in a curved fashion. Moreover, the cross runners may assist in supporting the electrical device and any other objects forming the ceiling, such as ceiling tiles.

[0028] The cross runners may be made of an electrically insulating material.

[0029] The cross runners may be made of an electrically conductive material. If the cross runners are made of an electrically conducive material, the cross runners may be electrically insulated with respect to the main runners in order to prevent short circuit between adjacent main runners of different polarities. The cross runners may be electrically insulated with respect to the main runners at one end or at both ends thereof.

[0030] The cross runners may be attached directly to the main runners as is known in the art. Some cross runners may be attached to a wall or another vertical object, e.g. when the suspended ceiling connects to a wall or a column. Those runners may also be referred to as edge profiles or edge runners.

[0031] The ceiling system may further comprise a set of carrier profiles overlying and supporting the main runners, wherein each carrier profile supports at least two main runners. By this arrangement the number of fixing or attachment points to a structural ceiling may be significantly reduced while allowing for desired distances between the main runners.

[0032] The carrier profiles may be arranged orthogonally with respect to the main runners.

[0033] The carrier profiles may be arranged at an oblique angle with respect to the main runners.

[0034] The electric voltage may be a direct voltage.

[0035] The electric voltage may be less than or equal to 120 volts, which is advantageous in that a safe system fulfilling certain legislative requirements may be realized. By keeping the electric voltage below or equal to 120 volts, the voltage may be classified as a safety extra low voltage, SELV.

[0036] The electric voltage may be less than or equal to 60 volts, which is advantageous in that a safe system requiring no contact safety devices may be realized.

[0037] The power source may be configured to supply a maximum power of 500 VA, which is advantageous in that a safe system fulfilling certain legislative requirements may be realized.

[0038] The power source may be configured to supply a maximum power of 200 VA, which is advantageous in that a safe system requiring no contact safety devices

may be realized.

[0039] The system may further comprise a control unit configured to transmit a control signal indicative of a desired power level of the electric device, which is advantageous in that the power level of the electric device may be set to a certain desires level.

[0040] The control unit may be a separate unit.

[0041] The control unit may be integrated in the power source.

[0042] The control unit may be used to control a plurality of electric devices. The plurality of electric devices may be controlled simultaneously using the same control signal. The plurality of electric devices may be controlled individually using dedicated control signals. The control signal may for this purpose include an identifier or address part identifying a certain electric device to be controlled.

[0043] The control unit may be used to control the power source or a plurality of power sources, thereby indirectly controlling the electric device or a plurality of electric devices.

[0044] The wording "control signal" may mean any type of signal carrying information pertaining to a desired power level of the electric device. The control signal may consequently have any format capable of carrying said information.

[0045] The control signal may be an analog signal and/or a digital signal. The control signal may be transmitted in a wire or a plurality of wires. The control signal may be transmitted wirelessly.

[0046] The control signal may be realized by the modulating the voltage supplied by the power source. In other words, the control signal may be contained in the voltage supplied by the power source.

[0047] The electric device may comprise a first receiver unit configured to receive the control signal transmitted by the control unit and to set the power level of the electric device to the desired power level. By this arrangement, e.g. a light intensity of a light or a sound intensity of a loud speaker may be set to a desired level.

[0048] The voltage supplied to the electric device by being applied between the at least one main runner and the first and second adjacent main runner may consequently be kept constant and/or maintained at specific level irrespective of the set power level of the electric device. This because the electric device itself may be configured to set a desired power level based on a received control signal.

[0049] The power source may comprise a second receiver unit configured to receive the control signal transmitted by the control unit and to set the electric voltage applied between the at least one main runner and the first and second adjacent main runner, respectively, such that the desired power level is set at the electric device. By this arrangement, the power level of the electric device or a plurality of electric devices may be set by adjusting the voltage applied between the main runners.

[0050] The electric device may be further supported by at least one cross runner interconnecting the at least one main runner and the first or second adjacent main runner, and comprising a further connector being in electric contact with said at least one cross runner, and wherein the control signal may be transmitted to the first receiver unit via the at least one cross runner and the further connector. By this arrangement the cross runner or a plurality of cross runners may be used as signaling infrastructure for the control signal meaning that no additional wirings or cables will have to be used for conveying the control signal.

[0051] A plurality of cross runners may thus be electrically connected to each other so as to form a common signaling infrastructure capable of reaching a plurality of electric devices. Correspondingly, a plurality of cross runners electrically connected to each other may form a common signaling infrastructure capable of reaching electric devices located at a distance from the control unit. In other words, the control signal may be sent through a plurality of cross runners together acting as a signal cable or wire.

[0052] Further, by connecting a plurality of cross runners electrically to each other a more robust system with redundant paths for the control signal may be achieved. In other words, the control signal may travel from the control unit to the first receiver through different paths formed by the cross runners.

[0053] The system may further comprise a ceiling tile supported by said at least one main runner and the first or second adjacent main runner, and arranged in the first or second space formed there between, which is advantageous in that a complete suspended ceiling including an electric device may be realized.

[0054] The electric device and the ceiling tile may be integrated in a tile unit, which is advantageous in that electric devices and ceiling tiles may be combined freely to achieve a desired suspended ceiling. For instance, lights, loudspeakers, fire detectors, presence detectors or similar may be integrated in ceiling tiles.

[0055] The electric device may be at least one of a light source, a loudspeaker, a sensor, a ventilation unit, a Wi-Fi access point, a display, a fan, an emergency light source, a camera and a power supply.

[0056] The system may comprise a first further electric device supported by said at least one main runner and the first or second adjacent main runner, and arranged in the first or second space formed there between.

[0057] The system may comprise a further power source, arranged to apply an electric voltage between a further one of the plurality of main runners and thereto associated first and second adjacent main runners, respectively, and a second further electric device supported by said further one main runner and an associated first or second adjacent main runner, and arranged in a first or second associated space, the second further electric device comprising connectors being in electric contact with said further one main runner and the associated first or second adjacent main runner such that the second

further electric device is powered by the applied electric voltage of the further power source.

[0058] By this arrangement, a ceiling may be divided into a plurality of different zones or modules including main runners being fed by different power sources. A plurality of advantages may be derived from this arrangement. A relatively speaking large ceiling including a large number of electric devices may be provided in a safe manner, where each and every zone may have a limited maximum power. The maximum power for each zone may for instance be kept below 200 VA, which is advantageous in that a safe system requiring no contact safety devices may be realized.

[0059] Further, a more robust system may be achieved. In case of malfunction of for instance a power source, only one zone may be affected. This means that a room being illuminated by electric devices in form of lights provided in different zones may not turn completely dark if a power source is failing, since light in other zones will still function. Similar advantages may of course be derived for other types of electric devices.

[0060] The zones or modules including main runners being fed by different power sources may be arranged arbitrary with respect to each other. For instance, different zones may be arranged consecutively after each other or side by side. Moreover, the zones may be arranged in a matrix like fashion where different zones are arranged consecutively after each other and side by side. When the zones are arranged consecutively after each other, the same main runners may run along more than one zone. In this case the main runner will be electrically interrupted between the different zones.

[0061] Further features of, and advantages with, the present invention will become apparent when studying the appended claims and the following description. The skilled person will realize that different features of the present invention may be combined to create embodiments other than those described in the following, without departing from the scope of the present invention.

Brief description of the drawings

[0062] The aspects of the invention, including its particular features and advantages, will be readily understood from the following detailed description and the accompanying drawings, in which:

Fig. 1 conceptually illustrates a ceiling system.

Fig. 2 is a simplified view of the system in Fig. 1 additionally including carrier profiles.

Fig. 3 schematically illustrates a layout of a ceiling system including a plurality of power sources and zones.

Detailed Description

[0063] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided for thoroughness and completeness, and fully convey the scope of the invention to the skilled person. Like reference numerals refer to like elements throughout the description.

[0064] Fig. 1 is a schematic perspective view conceptually depicting a ceiling system 100. The ceiling system 100 is in form of a suspended ceiling system 100. The ceiling system 100 comprises a supporting structure 102. The supporting structure 102 comprises a plurality of main runners 104a-c extending side by side. For reasons of simplicity there are three main runners 104a-c illustrated in Fig. 1. In addition, two main runners 104d-e are shown in phantom to indicate that the ceiling system 100 may include any number of main runners 104a-e extending side by side. The ceiling system 100 may thus be used to form a suspended ceiling of an arbitrary size.

[0065] The main runners 104a-e are made of an electrically conductive material. The main runners 104a-e may for example be made of steel or aluminum.

[0066] The main runner 104b has a first adjacent main runner in form of main runner 104a arranged on a first side and a second adjacent main runner in the form of main runner 104c arranged on a second side thereof. By this arrangement a first space 106 is formed between the main runner 104b and the first adjacent main runner 104a. Correspondingly, a second space 108 is formed between the main runner 104b and the second adjacent main runner 104c.

[0067] In the same way, corresponding spaces 110 are formed between main runners 104a and 104d and between main runners 104c and 104e respectively.

[0068] In the depicted ceiling system 100, the supporting structure 102 further includes cross runners 105. The cross runners 105 are optional and may or may not be present in the supporting structure 102. The depicted cross runners 105 are interconnecting the plurality of main runners 104a-e extending side by side, i.e. the cross runners 105 are attached to the respective main runners 104a-e. The length of the cross runners 105 is typically about the distance between two adjacent main runners. However, the cross runners may be arranged an oblique angle with respect to the main runners 104a-e. In this case the length of the cross runners 105 are typically adapted so as to interconnect adjacent main runners irrespective of the oblique angle. Some cross runners 105 are shown in phantom.

[0069] In the depicted ceiling system 100, two electrical devices 110, 112 are arranged in the first space 106 and the second space 108 respectively. The electric device 110 is supported by the main runners 104a, 104b, whereas the electric device 112 is supported by the main runners 104b, 104c. The electric devices 110, 112 are arranged adjacent to cross runners 105. As previously described, the cross runners 105 are optional. The cross

runners 105 may or may not be used to support the electric devices 110, 112.

[0070] The depicted electric device 112 is a lighting arrangement including a plurality of light sources used to illuminate a room located below the suspended ceiling formed by the ceiling system 100.

[0071] The depicted electric device 110 is a lighting arrangement including a single light source used to illuminate a room located below the suspended ceiling formed by the system 100.

[0072] A power source 114 is connected to the main runners 104a-c in order to supply a voltage V between respective adjacent main runners. In the depicted ceiling system 100 main runner 104b is connected to a positive terminal of the power source 114, whereas main runners 104a, 104b are connected to a negative terminal of the power source 114. The depicted power source 114 provides a direct voltage V. In this way an electric voltage V is applied between the main runners 104a and 104b. Correspondingly, an electric voltage V is applied between the main runners 104b and 104c.

[0073] Other types of voltages V than a direct voltage may be used. For instance, an alternating voltage V may be used.

[0074] The electric devices 110, 112 are provided with connectors 116, 118. The connectors 116 of the electrical devices 110, 112 are in electrical contact with the main runner 104b. The connector 118 of electrical device 110 is in electrical contact with the main runner 104a. The connector 118 of electrical device 112 is in electrical contact with the main runner 104c. In this way, the electrical device 110 may be powered by the electric voltage V applied between the main runners 104a and 104b whereas the electrical device 112 may be powered by the electric voltage V applied between the main runners 104b and 104c.

[0075] In order to control a power level of the electric devices 110, 112, the electric voltage V applied between the main runners 104a-c may be controlled. In case of a direct voltage V, the voltage V may be increased or decreased in order to control a power level of the electric devices. The voltage V may further be modulated or chopped in order to control a power level of the electric devices 110, 112. As is known in the art, the voltage V of the power source 114 may be controlled in a number of ways.

[0076] By controlling the voltage V of the power source 114 applied between the main runners 104a-c all electric devices 110, 112 supported by the main runners 104a-c are typically controlled simultaneously in response to controlling the voltage V.

[0077] The electric devices 110, 112 may however be controlled individually utilizing different strategies. This will be described in greater detail below.

[0078] The depicted ceiling system 100 also includes a ceiling tile 120 arranged in the first space 106 adjacent to the electric device 110. A single ceiling tile 120 is depicted for reasons of simplicity although any number of ceiling tiles 120 may be used with the ceiling system 100.

[0079] The depicted ceiling system 100 also includes a tile unit 122 arranged in the first space 106 adjacent to the electric device 110. The tile unit 122 is formed of a ceiling tile 120a which is integrated with an electric device 110a. The electric device 110a is electrically connected to the main runners 104a, 104b by means of connectors 116a, 118a extending from the electric device 110a to the respective main runners 104a, 104b. A single tile unit 122 is depicted for reasons of simplicity although any number of tile units 122 may be used with the ceiling system 100.

[0080] The maximum voltage V and maximum power supplied by the power source 114 may be limited in order to adhere to different safety regulations. Examples of relevant safety regulations include ELV, SELV, PELV, and FELV to give a few relevant examples. Examples of relevant maximum voltages include 120, 60 and 50 volts. However, any voltage may be used in practice. Examples of relevant maximum powers include 500 and 200 VA. However, any power may be used in practice.

[0081] The ceiling system 100 may also include additional entities for facilitating controlling of the power level of the electric devices 110, 110a, 112 and for controlling the power level of the electric devices 110, 110a, 112 individually or in groups including a plurality of electric devices 110, 110a, 112.

[0082] The ceiling system 100 may include a control unit 124 configured to transmit a control signal S indicative of a desired power level of an electric device 110, 110a, 112 or indicative of a desired power level of a plurality of electric devices 110, 110a, 112. The control unit 124 may be located at different locations in relation to the other entities or components of the ceiling system 100. The control unit 124 may be located in proximity to the power source 114. The control unit 124 may be located in the room in which the ceiling system 100 is used. The control unit 124 may be located in another room than the one in which the ceiling system 100 is used. The control unit 124 may be integrated in the power source 114. The control unit 124 may be or form part of an external control panel.

[0083] The control signal S may as exemplified in Fig. 1 be configured to be transmitted using a wire or may be transmitted wirelessly. The control signal may be transmitted using any suitable format.

[0084] The control signal S may instance adhere to the DALI (Digital Addressable Lighting Interface) standard which is a standardized digital protocol for light control. The control signal may be a 0-10 analog DC signal where 10 V typically corresponds to a light intensity or power level of 100 % whereas 0 V corresponds to a light intensity or power level of 0 %. The control signal S may be transmitted using a standardized 433 MHz wireless protocol. The control signal S may be transmitted using a Z-Wave protocol supporting two-way communication and mesh network architecture.

[0085] The depicted power source 114 of Fig. 1 com-

prises a receiver unit 128 or second receiver unit 128 configured to receive the control signal S transmitted by the control unit 124. The control signal S may thus be received at the power source 114 by the second receiver unit 128, whereby the power source 114 in response to receiving the control signal S may set the electric voltage applied between the main runner 104b and the first adjacent main runner 104a and second adjacent main runner 104c, respectively. In this way the desired power level is set at the electric devices 110, 110a, 112.

[0086] More specifically, by controlling the voltage between the main runners 104a and 104b the power level of the electric devices 110 and 110a may be set. Correspondingly, by controlling the voltage between the main runners 104b and 104c the power level of the electric device 112 may be set. In this way the power level of a plurality of electric devices 110, 110a, 112 may be set simultaneously in response to a single control signal.

[0087] In order to control a single electric device 110, 110a, 112 different strategies may be employed as will be described in greater detail below.

[0088] The depicted electric device 110 comprises an optional receiver unit 126 or first receiver unit 126 configured to receive the control signal S transmitted by the control unit 124. The first receiver unit 126 is configured to set the power level of the electric device 110 to a desired power level in response to receiving the control signal S.

[0089] In the depicted system 100 of Fig. 1 the first receiver unit 126 is configured to receive the control signal in form of a wireless signal. Alternatively, or in addition the first receiver unit 126 may be configured to receive the control signal S through the connectors 116, 118. The control signal S may in this case be transmitted in the main runners 104a-e, using the main runners 104a-e as a signaling infrastructure. The voltage applied between respective adjacent main runners may for instance be modulated so as to carry the control signal S.

[0090] As an alternative to using the main runners 104a-e as a signaling infrastructure is to use the cross runners 105 as a signaling infrastructure for the control signal S. This optional principle is also schematically depicted in Fig. 1 where electric device 110 in addition to being supported by the main runners 104a, 104b is also supported by two cross runners 105. The cross runners are interconnecting the main runners 104a, 104b as depicted in Fig. 1. The electric device 110 is thus employed with an optional further connector 130 being in electric contact with one of the cross runners 105 supporting the electric device 110. By this arrangement, the control signal S may consequently be transmitted to the first receiver unit 126 via the cross runners 105 and the further connector 130.

[0091] When controlling the power level of an individual electric device 110, such as electric device 110, comprising a first receiver unit 126 used in a system 100 including a plurality of electric devices 110, 110a, 112. The voltage between respective adjacent main runners, such as main runners 104a and 104b and main runners 104b and 104c, is preferably kept constant and the power level of the electric device 110 being controlled is preferably controlled or adjusted internally in the electric device 110 being controlled. There are numerous of principles that may be employed to control a power level of an electric device as is known in the art.

[0092] The power source 114 may be configured to monitor an actual power consumption of the electric devices 110, 110a, 112 being powered by the power source 114. The actual power consumption may be compared with an expected power consumption which for instance may be estimated based on the control signal S and the number and type of electric devices 110, 110a, 112 being powered by the power source 114. The power source may be configured to reduce or cut the voltage V being applied between the respective adjacent main runners, such as main runners 104a and 104b and main runners 104b and 104c, in case the actual power consumption deviates from the expected power consumption. In this way, defect electric devices 110, 110a, 112 may be spared from further damages. Also the risk of fire emanating from e.g. a short circuit may be reduced.

[0093] In practice, some deviations from the expected power consumption may be tolerated by the power source 114 without reducing or cutting the voltage V being applied between the respective adjacent main runners, such as main runners 104a and 104b and main runners 104b and 104c. In this way variations of the power consumption may be allowed within a certain interval without affecting the overall operation of the system 100. For instance, predetermined positive offset of the expected power consumption may be tolerated without reducing or cutting the voltage V.

[0094] The power source 114 may be specifically configured to monitor short circuits in the system 100. The power source 114 may in response to a detected short circuit in the system 100 sound or transmit an alarm. A short circuit between main runners 104a and 104b and main runners 104b and 104c may typically be detected. A short circuit may originate from a wrongfully mounted cross runner 105 or from a defect cross runner 105 void of sufficient insulation in respect to the main runners 104a-e.

[0095] It is thus possible to during installation of the system 100 to avoid or reduce the risk of defect or wrongfully mounted cross runners 105, by first mounting the main runners 104a-e and thereafter apply the voltage V between the main runners 104a-e. During a subsequent mounting of cross runners 105 between the main runners 104a-e, the power supply 114 may monitor and transmit an alarm if a short circuit occurs.

[0096] Above, the ceiling system 100 has been described in a general manner for reasons of simplicity, the ceiling system 100 has mainly been described so as to include electric devices 110, 112, 110a in form of light sources. As is evident, the described ceiling system 100 may equally well be used with other electric devices such

as loudspeakers, sensors, ventilation units, Wi-Fi access points, displays, fans, emergency light sources, cameras and power supplies to give a few relevant examples. In other words, other types of electric devices 110, 110a, 112 may equally well be powered by the voltage V applied by the power source 114 between the main runners 104a and 104b. Correspondingly, other types of electric devices 110, 110a, 112 may equally well be powered by the voltage V applied by the power source 114 between the main runners 104b and 104c.By powering a power supply by the voltage V applied by the power source 114 between the main runners 104a and 104b or by the voltage V applied by the power source 114 between the main runners 104b and 104c, a voltage different form the voltage V may be realized in the system. It is thus possible to power electric devices requiring different voltages simultaneously be the system 100. Further, if an adjustable power supply is powered by the voltage V, a plurality off different voltages different from the voltage V may be realized in the system 100.

[0097] Now referring to Fig. 2. Here the system 100 of Fig. 1 is illustrated in a simplified manner. As previously described, the system 100 includes a plurality of main runners 104a-d. As illustrated in Fig. 2, the main runners 104a-d may be supported by a set of carrier profiles 132. The depicted carrier profiles 132 overlies and supports the main runners 104a-d. As is shown in Fig. 2, the carrier profiles 132 overlies and supports all five main runners 104a-d of Fig. 2. However, the carrier profiles 132 may overlie and support any number of main profiles 104a-d. Moreover, different carrier profiles 132 may overlie different number of main runners 104a-d.

[0098] In case the carrier profiles 132 are made of an electrically conducive material, the carrier profiles 132 are preferably electrically insulated with respect to the main runners 104a-d in order to prevent short circuit between adjacent main runners 104a-d of different polarities. In practice, the carrier profiles 132 may in certain cases be electrically insulted with respect to main runners 104a-d having a certain polarity. The electrical insulation between the carrier profiles 132 and the main runners 104a-d may for instance be achieved by providing a sheet of an insulating material between the carrier profiles 132 and the main runners 104a-d at locations where the carrier profiles 132 and the main runners 104a-d overlap. By utilizing carrier profiles 132 overlying and supporting the main runners 104a-d the number of suspension points or attachment points to for instance a structural ceiling may be significantly reduced.

[0099] Now referring to Fig. 3, here is conceptually depicted a ceiling system 100 being similar to the ceiling system depicted in Fig. 1. The description of the ceiling system 100 of Fig. 1 is equally applicable to the ceiling system 100 depicted in Fig. 3, why only relevant differences between the respective ceiling systems 100 will be described below in order to avoid undue repetition.

[0100] The ceiling system 100 of Fig. 3 comprises a further power source 114' apart from a single power source 114 as described and depicted in conjunction with Fig. 1. More specifically, the ceiling system 100 of Fig. 3 is employed with two power sources, namely the power sources 114 and 114'. Similarly, to what has been described in conjunction with Fig. 1 above, the power source 114 is arranged to apply an electric voltage V between respective adjacent main runners 104a-c. More specifically, an electric voltage V is applied between the main runners 104a and 104b by power source 114. Correspondingly, an electric voltage V is applied between the main runners 104b and 104c by power source 114.

[0101] In the same fashion, the further power source 114' is arranged to apply an electric voltage V' between respective adjacent main runners 104a'-c'. More specifically, an electric voltage V' is applied between the main runners 104a' and 104b' by power source 114'. Correspondingly, an electric voltage V' is applied between the main runners 104b' and 104c' by power source 114'.

[0102] As can be seen in Fig. 3, the polarity of the respective power sources 114, 114' are reversed, which brings about that each and every main runner 104a-c, 104a'-c'will have an opposite polarity compared to its adjacent main runners 104a-c, 104a'-c'. In other words, an electric voltage V, V' will be applied between each and every pair of adjacent main runners 104a-c, 104a'-c' forming the spaces 106, 108, 109, 106', 108'. This is further indicated by the + and - signs provided in Fig. 3.

[0103] Alternatively, the polarity of the respective power sources 114, 114' may not be reversed, i.e. the polarities may be equal for the power sources 114, 114'. In this case the main runners 104a and 104c' forming the space 109 will have the same polarity in practice bringing about that no voltage is applied between the main runners 104a and 104c'. The space 109 may however advantageously be used for receiving conventional ceiling tiles 120.

[0104] In the depicted system 100 of Fig. 3, an electric device 112' is supported by the main runner 104b' and 104c'and consequently arranged in the space 106'. Like the electric device 110, described in detail in conjunction with Fig. 1, the electric device 112' is provided with connectors 116', 118'. The connector 116' of the electrical device 112' is in electrical contact with the main runner 104c'. The connector 118' of electrical device 112' is in electrical contact with the main runner 104c'. In this way, the electrical device 112' may be powered by the electric voltage V' applied by the power source 114' between the main runners 104b' and 104c'.

[0105] The electrical device 112' may be controlled as described above in conjunction with Fig. 1. How the electrical device 112' may be controlled will consequently not be described in order to avoid undue repetition.

[0106] Power source 114' may be arranged to power further electric devices arranged in the spaces 106'and 108'.

[0107] The system 100 may include further power sources apart from one or two power sources as described above. If further power sources are introduced,

further main runners are also introduced correspondingly. In other words, a power source and the main runners connected thereto may be said to form a zone or a module capable of powering a plurality of electric devices. Such zones or modules may for instance be arranged side bay side as depicted in Fig. 3 or may be arranged one after another along a common direction. In the latter case, the main runners of the respective modules may extend along a common direction and may coincide along common geometric lines. The main runners of the respective modules are may then typically discontinued so as to be electrically separated although extending along a common line or lines.

[0108] Respective modules or zones of a ceiling system may extend side by side and/or one after another.

[0109] Additionally, even though the invention has been described with reference to specific exemplifying embodiments thereof, many different alterations, modifications and the like will become apparent for those skilled in the art.

[0110] Thus, variations to the disclosed embodiments may be understood and effected by the skilled addressee in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. Furthermore, in the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

Claims

1. A ceiling system (100) comprising;
a supporting structure (102) comprising a plurality of main runners (104a-e) made of an electrically conductive material and extending side by side, wherein at least one of the plurality of main runners (104b) has a first adjacent main runner (104a) arranged on a first side and a second adjacent main runner (104c) arranged on a second side such that a first space (106) is formed between the at least one main runner (104b) and the first adjacent main runner (104a) and a second space (108) is formed between the at least one main runner (104b) and the second adjacent main runner (104c),
an electric device (110, 110a, 112) supported by said at least one main runner (104b) and the first (104a) or second adjacent main runner (104b), and arranged in the first (106) or second space (108) formed there between; and
a power source (114) arranged to apply an electric voltage (V) between the at least one main runner (104b) and the first (104a) and second adjacent main runner (104c), respectively, and wherein
the electric device (110, 110a, 112) comprising connectors (116, 118) being in electric contact with said at least one main runner (104b) and the associated first (104a) or second adjacent main runner (104c) such that the electric device (110, 110a, 112) is powered by the applied electric voltage (V).

2. The system (100) according to claim 1, wherein the supporting structure (102) further comprising cross runners (105) interconnecting the plurality of main runners (104a-e) extending side by side.

3. The system (100) according to claim 1 or 2, further comprising a set of carrier profiles (132) overlying and supporting the main runners (104a-d), wherein each carrier profile (132) supports at least two main runners (104a-d).

4. The system (100) according to any one of the preceding claims,
wherein the electric voltage (V) is a direct voltage.

5. The system (100) according to any one of the preceding claims,
wherein the electric voltage (V) is less than or equal to 120 volts.

6. The system (100) according to any one of the preceding claims,
wherein the power source (114) is configured to supply a maximum power of 500 VA.

7. The system (100) according to any one of the preceding claims, the system (100) further comprising a control unit (124) configured to transmit a control signal (S) indicative of a desired power level of the electric device (110, 110a, 112).

8. The system (100) according to claim 7, wherein the electric device (110, 110a, 112) comprises a first receiver unit (126) configured to receive the control signal (S) transmitted by the control unit (124) and to set the power level of the electric device (110, 110a, 112) to the desired power level.

9. The system (100) according to claim 7, wherein the power source (114) comprises a second receiver unit (128) configured to receive the control signal (S) transmitted by the control unit (124) and to set the electric voltage applied between the at least one main runner (104b) and the first (104a) and second adjacent main runner (104c), respectively, such that the desired power level is set at the electric device (110, 110a, 112).

10. The system (100) according to claim 8, wherein the electric device (110, 110a, 112) is further supported by at least one cross runner (105) interconnecting the at least one main runner (104b) and the first (104a) or second adjacent main runner (104c), and comprises a further connector (130) being in electric contact with said at least one cross runner (105), and wherein the control signal (S) is transmitted to the

first receiver unit (126) via the at least one cross runner (105) and the further connector (130).

11. The system (100) according to any one of the preceding claims, the system (100) further comprising a ceiling tile (120) supported by said at least one main runner (104b) and the first (104a) or second adjacent main runner (104c), and arranged in the first (106) or second space (108) formed there between.

12. The system (100) according to claim 11, wherein the electric device (110a) and the ceiling tile are integrated in a tile unit (122).

13. The system (100) according to any one of the preceding claims,
wherein the electric device (110, 110a, 112) is at least one of a light source, a loudspeaker, a sensor, a ventilation unit, a Wi-Fi access point, a display, a fan, an emergency light source, a camera and a power supply.

14. The system (100) according to any one of the preceding claims, the system (100) comprising a first further electric device (112) supported by said at least one main runner (104b) and the first (104a) or second adjacent main runner (104c), and arranged in the first (106) or second space (108) formed there between.

15. The system (100) according to any one of the preceding claims, the system (100) comprising a further power source (114'), arranged to apply an electric voltage between a further one of the plurality of main runners (104b') and thereto associated first (104a') and second adjacent main runners (104c'), respectively, and
a second further electric device (112') supported by said further one main runner (104b') and an associated first (104a') or second adjacent main runner (104c'), and arranged in a first (106') or second associated space (108'),
the second further electric device (112') comprising connectors (116', 118') being in electric contact with said further one main runner (104b') and the associated first (104a') or second adjacent main runner (104c') such that the second further electric (112') device is powered by the applied electric voltage (V') of the further power source (114').

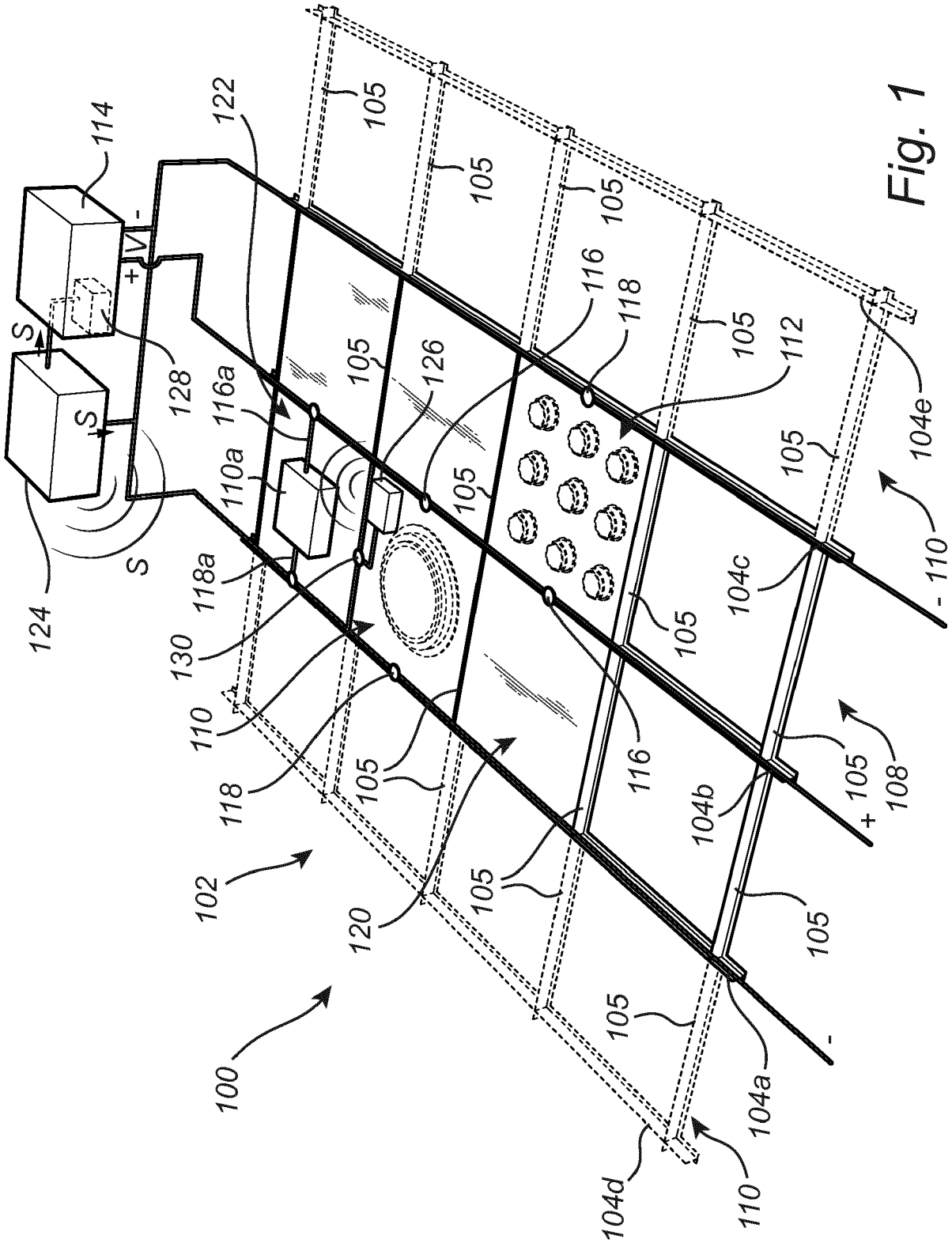
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Fig. 1

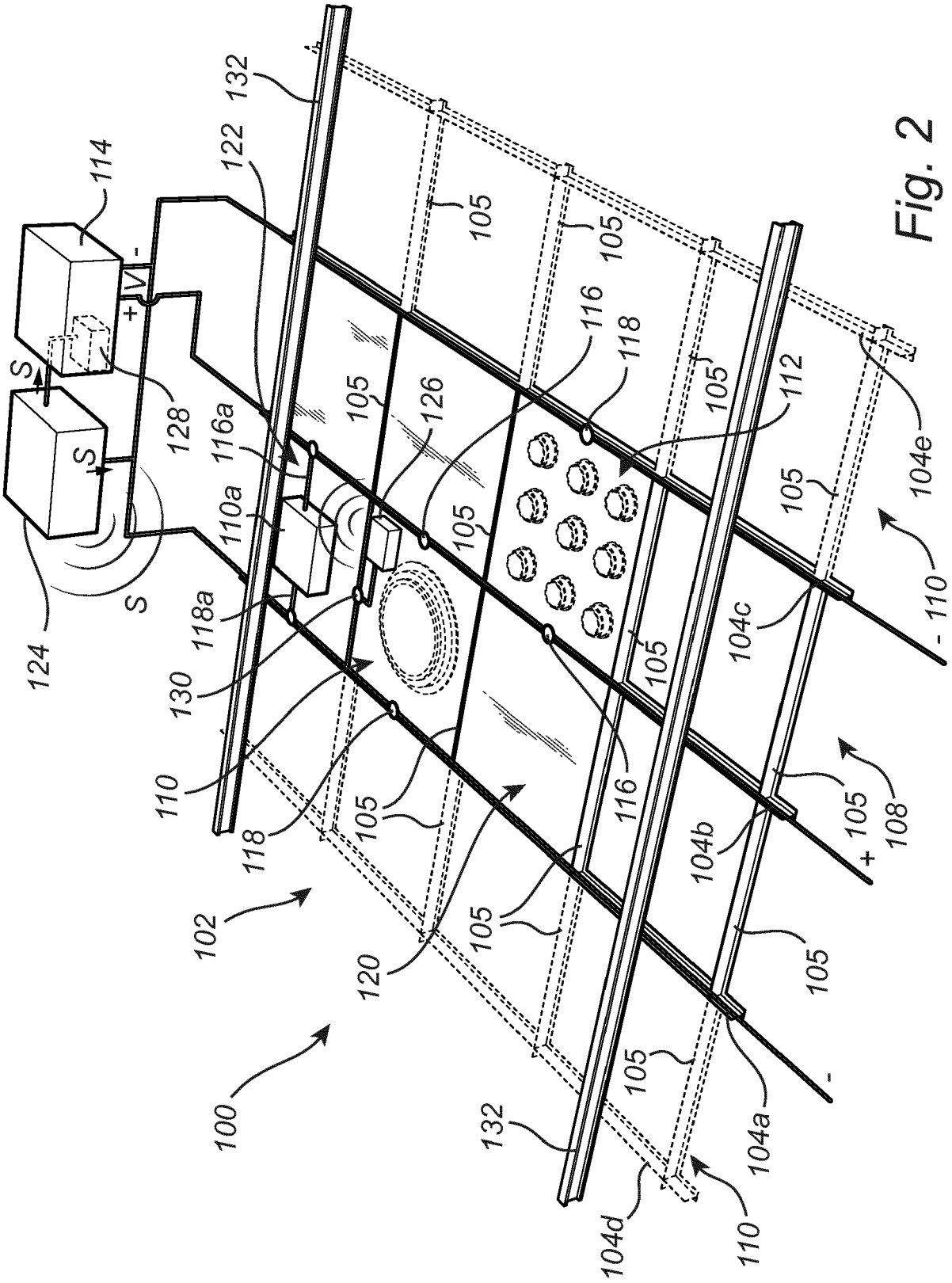
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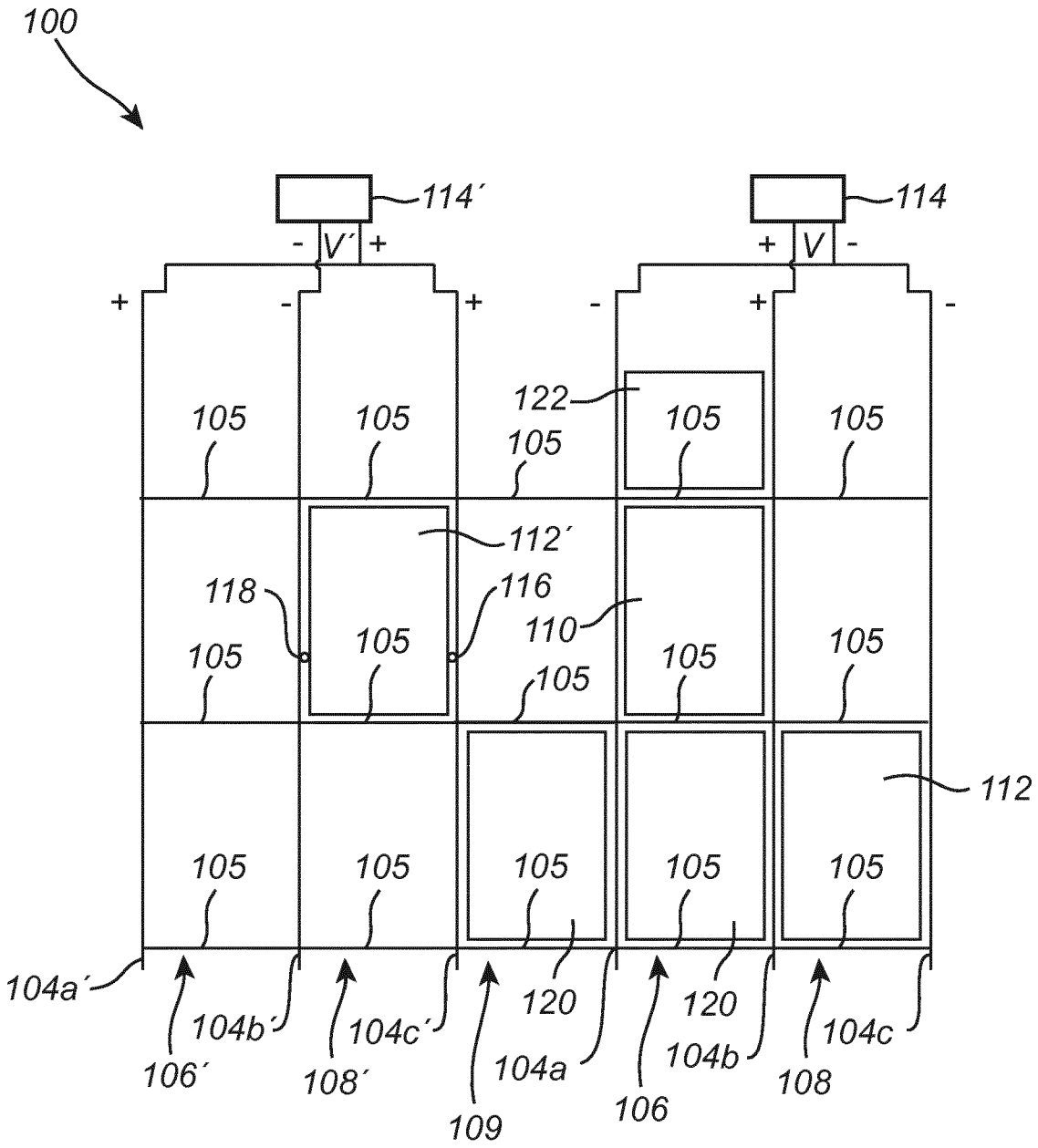
Fig. 2


100
114´
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V´
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122
105
112´
118
116
110
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104a´
104b´
104c´
120
104a
104b
104c
106´
108´
109
106
108

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 3288

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2015/172075 A1 (BAILEY GEORGE R [US]) 12 November 2015 (2015-11-12) * page 11, line 24 - line 30; figures 1-3, 7A-B, 12 * * page 31, line 11 - page 32, line 6 * * page 42, line 14 - page 43, line 8 *	1-15	INV. E04B9/00 E04B9/06
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E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 January 2020	Lopes, Claudia

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