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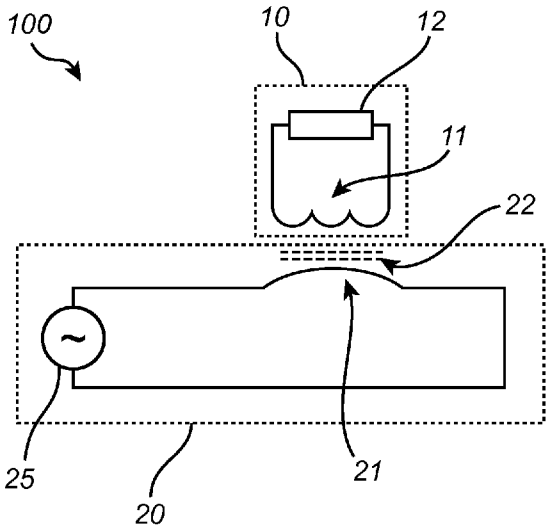

Fig. 1

(57) Abstract: A lighting arrangement (100) is disclosed, comprising a first electrical device (10), comprising at least one elongated carrier (15; 71, 72) arranged to support at least one light-emitting element (12), the at least one elongated carrier (15; 71, 72) being configured to provide power to the at least one light-emitting element (12). The lighting arrangement (100) comprises a second electrical device (20), which may be configured to supply power to the first electrical device (10). The at least one elongated carrier (15; 71, 72) of the first electrical device (10) comprises a first electrical interconnection element (11; 13, 14) and the second electrical device (20) comprises a second electrical interconnection element (21; 23, 24). The first electrical interconnection element (11; 13, 14) and the second electrical interconnection element (21; 23, 24) are configured to electrically interconnect the first electrical device (10) and the second electrical device (20) by means of at least one of inductive coupling or capacitive coupling.

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LIGHTING ARRANGEMENT WITH NON-GALVANICALLY INTERCONNECTED DEVICES

TECHNICAL FIELD

The present invention relates to a lighting arrangement comprising a first electrical device, comprising at least one elongated carrier arranged to support at least one light-emitting element, the at least one elongated carrier being configured to provide power to the at least one light-emitting element, and a second electrical device configured to supply power to the first electrical device, wherein the first electrical device and the second electrical device can be non-galvanically interconnected.

BACKGROUND

Light strips – for example comprising flexible printed circuit boards (PCBs) configured to support one or more light sources – may facilitate installation of several light sources to achieve a desirable light effect. Light emitting diode (LED) light strips are widely available and used for various applications, including outdoor lighting (e.g., architectural lighting) and indoor lighting, and are used in both consumer and professional applications. Advantages with LED strips include miniaturization and a flexibility with regard to form factor. Some LED strips may be relatively easily customized, e.g., they may be cut to a desired length. LED strips may for example have a length from one to several meters, such as up to five meters or even more. LED strips may include several LEDs which for example may be arranged as one or more LED strings. For example, a LED strip may comprise a flexible PCB which is configured to support one or more LEDs or LED strings, and which may be covered with a transparent material or a diffusor. For outdoor applications, LED strips may be covered by a conformal coating made or encapsulated by a sleeve for example made of Silicone or Polyurethane or a similar material.

Electrical interconnection between LED strips or other types of light strips and associated driving circuitry may be challenging. The electrical interconnection may be achieved using soldering. However, soldering close to (heat) sensitive LEDs needs to be done with care, as LEDs may become overheated quickly, which may cause damage to the LEDs. Also, electrostatic discharge (ESD) related incidents may occur if soldering is not carried out using proper ESD safety measures. For outdoor applications, interconnection may be

hampered by the IP6x encapsulation technology (e.g., a conformal coating or sleeve), which may require that the LED strip prior to the interconnection is prepared either by locally removing the conformal coating or by using dedicated connectors. Gels may have to be used to guarantee IP6x waterproof quality. Even with such relatively expensive connectors, the interconnection may suffer from vibration, poor mechanical robustness, alignment issues, corrosion, etc. For indoor applications using such dedicated connectors, the interconnection may suffer from poor mechanical robustness, poor reliability (e.g., if using different metal finishing on the connector and the LED strip due to electro-corrosion, or caused by so called fretting corrosion which may result from very small movements of the connector and/or the LED strip in combination with corrosion of the metal finishing on the connector and/or the LED strip; fretting corrosion may arise particularly during high-humidity and high-temperature conditions), solder fatigue, vibration sensitivity, etc.

SUMMARY

In view of the above, a concern of the present invention is to provide for means to achieve electrical interconnection between an electrical device, e.g., in the form of a light strip or the like, such as for example, a LED strip, and another electrical device, which for example may be a driver for the light strip, which may alleviate or even eliminate one or more of the disadvantages discussed in the foregoing.

To address at least one of this concern and other concerns, a lighting arrangement and a first electrical device in accordance with the independent claims are provided. Preferred embodiments are defined by the dependent claims.

According to a first aspect of the present invention there is provided a lighting arrangement comprising a first electrical device and a second electrical device. The first electrical device comprises at least one elongated carrier arranged to support at least one light-emitting element. The at least one elongated carrier is configured to provide power to the at least one light-emitting element. The at least one elongated carrier of the first electrical device comprises a first electrical interconnection element (or circuitry), and the second electrical device comprises a second electrical interconnection element (or circuitry). The first electrical interconnection element and the second electrical interconnection element are configured to electrically interconnect the first electrical device and the second electrical device by means of at least one of inductive coupling or capacitive coupling.

The second electrical device may be configured to supply power to the first electrical device. By the first electrical interconnection element and the second electrical

interconnection element being configured to electrically interconnect the first electrical device and the second electrical device by means of at least one of inductive coupling or capacitive coupling, there may be facilitated or enabled for the second electrical device to supply power to the at least one elongated carrier of the first electrical device by means of at least one of inductive power transfer or capacitive power transfer between the second electrical interconnection element and the first electrical interconnection element. Similarly, and in alternative or in addition, the first electrical device may be configured to supply power to the second electrical device, by means of at least one of inductive power transfer or capacitive power transfer between the first electrical interconnection element and the second electrical interconnection element.

As will be further described in the following, the at least one elongated carrier of the first electrical device may for example comprise one or more flexible printed circuit boards (PCBs) and/or one or more flexible foils ('flexfoils') configured to support the at least one light-emitting element and configured to provide power to the at least one light-emitting element (e.g., by way of the at least one elongated carrier including one or more electrically conductive tracks or traces, as known in the art). The at least one elongated carrier of the first electrical device may for example comprise a strip (e.g., a light strip), such as, for example, a LED strip.

Neither inductive power transfer nor capacitive power transfer may require any soldering or metallic connection (e.g., a dedicated connector as described in the foregoing) in order to achieve an electrical interconnection between the first electrical device and the second electrical device. Therefore, the lighting arrangement may facilitate or allow for achieving an electrical interconnection between the first electrical device and the second electrical device that is waterproof (e.g., by there being no need to penetrate or open a conformal coating or sleeve (or IP6x seal)), corrosion free (or be susceptible to only relatively little corrosion), relatively insensitive to vibration or misalignment of the first electrical device and the second electrical device relatively to each other, has no or only small ohmic losses (due to no or only relatively small resistance in the electrical interconnection interface) and/or has no or only relatively minor sparking safety issues.

As will be further described in the following, in order to facilitate or enable an electrical interconnection between the first electrical device and the second electrical device by means of inductive coupling, the at least one elongated carrier of the first electrical device may incorporate a coil element (or several coil elements). The coil element(s) may together with a magnetic element (e.g., one or more magnetic cores) of the first and/or second

electrical device and one or more coil elements of the second electrical device form a transformer arrangement facilitating or allowing for inductive power transfer between the first electrical device and the second electrical device. The coil element(s) of the first electrical device and possibly the magnetic element may be included in or constitute the first electrical interconnection element of the first electrical device. The one or more coil elements of the second electrical device and possibly the magnetic element may be included in or constitute the second electrical interconnection element of the second electrical device. In order to facilitate or enable an electrical interconnection between the first electrical device and the second electrical device by means of capacitive coupling, the at least one elongated carrier of the first electrical device may incorporate or form a capacitive electrode element(s), which may provide for a capacitive coupling with another capacitive electrode element(s) of the second electrical device, which capacitive coupling may facilitate or allow for capacitive power transfer between the first electrical device and the second electrical device.

According to a second aspect of the present invention, there is provided a first electrical device, which comprises at least one elongated carrier arranged to support at least one light-emitting element and configured to provide power to the at least one light-emitting element. The first electrical device is configured to be used in conjunction with a lighting arrangement according to the first aspect.

According to a third aspect of the present invention, there is provided a second electrical device configured to be used in conjunction with a lighting arrangement according to the first aspect and to supply power to the at least one elongated carrier of the first electrical device of the lighting arrangement.

The second electrical device may, similar to the first electrical device, for example comprise at least one elongated carrier arranged to support at least one light-emitting element and configured to provide power to the at least one light-emitting element.

In alternative or in addition, the second electrical device may comprise driver circuitry for controlling operation of the at least one light-emitting element of the at least one elongated carrier of the first electrical device. The at least one light-emitting element of the at least one elongated carrier of the first electrical device may accordingly be electronically controllable.

The at least one elongated carrier of the first electrical device and/or the second electrical device may for example be flexible and/or foldable. As will be further described in the following, by means of at least the at least one elongated carrier of the first electrical device being flexible and/or foldable, configurations of the at least one elongated

carrier of the first electrical device may be realized which may facilitate or enable for a relatively high inductive and/or capacitive coupling efficiency in the electrical interconnection between the first electrical device and the second electrical device.

The at least one elongated carrier of the first electrical device and/or the second electrical device may for example comprise at least one flexible PCB configured to support at least one light-emitting element and configured to provide power to the at least one light-emitting element (e.g., by way of the at least one elongated carrier including one or more electrically conductive tracks or traces, as known in the art). The at least one elongated carrier of the first electrical device and/or the second electrical device may for example comprise a (light) strip.

Each or any one of the light-emitting element(s) comprised in the at least one elongated carrier of the first electrical device and/or the second electrical device may for example include or be constituted by a solid state light emitter. Examples of solid state light emitters include light-emitting diodes (LEDs) and organic LEDs (OLEDs). Solid state light emitters are relatively cost efficient light sources since they in general are relatively inexpensive and have a relatively high optical efficiency and a relatively long lifetime. However, in the context of the present application, the term "light-emitting element" should be understood to mean substantially any device or element that is capable of emitting radiation in any region or combination of regions of the electromagnetic spectrum, for example the visible region, the infrared region, and/or the ultraviolet region, when activated e.g. by applying a potential difference across it or passing a current through it. Therefore, a light-emitting element can have monochromatic, quasi-monochromatic, polychromatic or broadband spectral emission characteristics. Examples of light-emitting elements include semiconductor, organic, or polymer/polymeric LEDs, violet LEDs, blue LEDs, optically pumped phosphor coated LEDs, optically pumped nano-crystal LEDs or any other similar devices as would be readily understood by a person skilled in the art. Furthermore, the term light-emitting element can, according to one or more embodiments of the present invention, mean a combination of the specific light-emitting element(s) which emit the radiation in combination with a housing or package within which the specific light-emitting element(s) is positioned or arranged. For example, the term light-emitting element or light-emitting module can encompass a bare LED die arranged in a housing, which may be referred to as a LED package. According to another example, the light-emitting element may comprise a Chip Scale Package (CSP) LED, which may comprise a LED die directly attached to a substrate such as a PCB, and not via a sub-mount.

The at least one elongated carrier of the first electrical device and/or the second electrical device may for example comprise at least one LED strip.

The (at least one elongated carrier of) the first electrical device and/or the second electrical device, e.g., comprising at least one LED strip, may be employed in both professional and consumer lighting applications. Possible applications include but are not limited to cove lighting, architectural lighting, retail shelf lighting, outdoor linear lighting (e.g., public space lighting), and embedded lighting (e.g. lighting of facades, furniture, window frames, etc.). Other applications in which the (at least one elongated carrier of) the first electrical device and/or the second electrical device may be useful are radio frequency antennas and magnetic sensors.

As mentioned in the foregoing, the second electrical device may comprise driver circuitry for controlling operation of the at least one light-emitting element of the at least one elongated carrier of the first electrical device. The driver circuitry may for example comprise LED driver circuitry configured to drive (or control) one or more LEDs which may be comprised in the second electrical device.

The at least one elongated carrier of the first electrical device may for example comprise at least one opening in the at least one elongated carrier, which at least one opening may extend between a first side of the at least one elongated carrier and a second side of the at least one elongated carrier. The first electrical interconnection element of the first electrical device and/or the second electrical interconnection element of the second electrical device may comprise at least one magnetic element (e.g., at least one magnetic core) which may extend through the at least one opening in the at least one elongated carrier of the first electrical device. The at least one opening in the at least one elongated carrier may for example comprise or be constituted by a through-hole and/or a slit in the at least one elongated carrier.

The at least one elongated carrier of the first electrical device may comprise at least one electrical conductor, which may extend in or on at least a portion of the elongated carrier and be arranged so as to extend around the at least one opening so as to form a coil element about the at least one opening. The at least one electrical conductor may extend around the at least one opening so as to form a coil element which may have one or more windings (possibly one or more complete or full windings and a partially completed winding), about the at least one opening. There may possibly be provided several such coil elements, which each may have one or more windings. The coil element(s) may be included in or constitute the first electrical interconnection element of the first electrical device. The at

least one electrical conductor may extend in or on at least a portion of the elongated carrier so as to be at least in part embedded in the elongated carrier and/or be provided on an outer surface of the elongated carrier. By means of the coil element(s) of the first electrical device and the at least one magnetic element, an electrical interconnection between the first electrical device and the second electrical device by means of inductive coupling may be facilitated or enabled. The second electrical device may include one or more coil elements similar to the coil element(s) of the first electrical device, which coil element(s) of the second electrical device may be included in or constitute the second electrical interconnection element of the second electrical device. The at least one electrical conductor of the at least one elongated carrier of the first electrical device may be arranged so as to form a closed circuit. Another way to describe this is that the at least one elongated carrier of the first electrical device may comprise a return line, or return conductor, connected to the at least one electrical conductor (or forming a part thereof) so as to form a closed circuit for current flowing therein.

The return line or conductor may not necessarily be a part or portion of the at least one electrical conductor of the at least one elongated carrier, but it could for example be a separate wire or other type of conductor that may interconnect two ends of the at least one electrical conductor of the at least one elongated carrier.

In the context of the present application, by an electrical conductor extending in or on at least a portion of the elongated carrier, it is meant that at least a portion of the electrical conductor may extend on (e.g., be provided on) an outer surface of the elongated carrier, that at least a portion of the electrical conductor may extend within the elongated carrier so as to be at least in part embedded in the elongated carrier, or that one or more portions of the electrical conductor may extend on (e.g., be provided on) an outer surface of the elongated carrier and one or more other portions of the electrical conductor may extend within the elongated carrier so as to be at least in part embedded in the elongated carrier.

According to one or more embodiments of the present invention, the at least one electrical conductor of the at least one elongated carrier of the first electrical device may be required or desired to cross at one or more locations. This may for example be implemented or realized by means of employing multi-layer flexible PCB(s) or multi-layer flexfoil, or by means of employing so called zero-ohm resistors or zero-ohm links on or in the at least one elongated carrier.

As described in the foregoing and in the following, the at least one elongated carrier of the first electrical device may incorporate several coil elements, which may be

included in or constitute the first electrical interconnection element of the first electrical device. This may for example be implemented or realized by means of employing a multi-layer PCB(s), possibly flexible multi-layer PCB(s), wherein different coil elements may be arranged at least in part in different layers of the multi-layer PCB(s).

As described in the foregoing and in the following, the first electrical device and/or the second electrical device may comprise at least one magnetic element (e.g., at least one magnetic core), which may be included in or constitute the first electrical interconnection element of the first electrical device and/or the second electrical interconnection element of the second electrical device. The magnetic element(s) or magnetic core(s) may in principle comprise any magnetic material. The magnetic element(s) or magnetic core(s) may for example comprise one or more ferrite ceramics (e.g., a 'ferrite core') or the like, which material may be particularly suitable for high-frequency applications.

As mentioned in the foregoing, the at least one elongated carrier of the first electrical device may be flexible. A portion (e.g., along a length) of the at least one elongated carrier may be arranged in a rolled-up arrangement having a central, or substantially central, through-hole. Possibly, the portion of the at least one elongated carrier may be fixedly arranged in the rolled-up arrangement, for example by means of gluing or some other appropriate coupling or connection means. The at least one elongated carrier of the first electrical device may comprise at least one electrical conductor extending in or on at least the portion of the elongated carrier that is arranged in a rolled-up arrangement so as to form a coil element about the central through-hole. For example, the at least one elongated carrier of the first electrical device may be rolled up at one end of the at least one elongated carrier so as to form a roll. The coil element may have a one or more windings, possibly one or more complete or full windings and a partially completed winding. In general, the more windings the coil element has, the more effective the inductive coupling efficiency in the electrical interconnection between the first electrical device and the second electrical device may become. There may possibly be provided several such coil elements, which each may have one or more windings. The coil element(s) may be included in or constitute the first electrical interconnection element of the first electrical device. The first electrical interconnection element of the first electrical device and/or the second electrical interconnection element of the second electrical device may comprise at least one magnetic element (e.g., at least one magnetic core) which may extend (completely or partially) through the central through-hole. The at least one electrical conductor may extend in or on at least the portion of the elongated carrier that is arranged in a rolled-up arrangement so as to be at least in part embedded in the

elongated carrier and/or be provided on an outer surface of the elongated carrier. By means of the coil element(s) of the first electrical device and the at least one magnetic element, an electrical interconnection between the first electrical device and the second electrical device by means of inductive coupling may be facilitated or enabled. The second electrical device may include one or more coil elements similar to the coil element(s) of the first electrical device, which coil element(s) of the second electrical device may be included in or constitute the second electrical interconnection element of the second electrical device. The at least one electrical conductor of the at least one elongated carrier of the first electrical device may be arranged so as to form a closed circuit. The at least one elongated carrier of the first electrical device may comprise a return line or conductor connected to the at least one electrical conductor (or forming a part thereof) so as to form a closed circuit for current flowing therein.

The first electrical device may comprise a plurality of elongated carriers. For example, the first electrical device may comprise at least two elongated carriers. Each of the at least two elongated carriers may be flexible and may comprise at least one electrical conductor extending in or on at least a portion of the elongated carrier. The electrical conductors of the at least two elongated carriers may be arranged such that the direction of current in at least two of the electrical conductors is opposite to each other. The at least two elongated carriers may be in a wound relation with respect to each other at least at the respective portions of the elongated carriers in which at least one electrical conductor extends such that at least one opening is formed between at least portions of the at least two elongated carriers. The at least portions of the at least two elongated carriers may form a coil element about the at least one opening. The coil element may have one or more windings, possibly one or more complete or full windings and a partially completed winding. In general, the more windings the coil element has, the more effective the inductive coupling efficiency in the electrical interconnection between the first electrical device and the second electrical device may become. There may possibly be provided several such coil elements, which each may have one or more windings. The coil element(s) may be included in or constitute the first electrical interconnection element of the first electrical device. The first electrical interconnection element of the first electrical device and/or the second electrical interconnection element of the second electrical device may comprise at least one magnetic element (e.g., at least one magnetic core) extending through the at least one opening. The at least two elongated carriers may be in a wound relation with respect to each other along an axis of the at least two elongated carriers and/or the first electrical device. By means of the

coil element(s) of the first electrical device and the at least one magnetic element, an electrical interconnection between the first electrical device and the second electrical device by means of inductive coupling may be facilitated or enabled. The second electrical device may include one or more coil elements similar to the coil element(s) of the first electrical device, which coil element(s) of the second electrical device may be included in or constitute the second electrical interconnection element of the second electrical device. The electrical conductors of the at least two elongated carriers of the first electrical device may be arranged so as to form closed circuits. The electrical conductors of the at least two elongated carriers of the first electrical device may comprise return lines or conductors connected to the respective electrical conductors (or forming a part thereof) so as to form closed circuits for current flowing therein.

The at least two elongated carriers may be in a wound relation with respect to each other at least at the respective portions of the elongated carriers in which at least one electrical conductor extends such that several openings are formed between at least portions of the at least two elongated carriers. The at least one magnetic element may for example comprise a base portion and two or more legs extending from the base portion. For example, the at least one magnetic element may for example comprise a so called “U” core, having two legs, or a so called “E” core, having three legs. “U” and “E” cores are as such known in the art. The different legs of the magnetic element may extend through different openings formed between at least portions of the at least two elongated carriers.

In the context of the present application, by at least two elongated carriers being in a wound relation about each other, it is meant that at least one of the at least two elongated carriers is wound about at least one other of the at least two elongated carriers. For example, there may be two or more of the different elongated carriers that are mutually wound about each other or twisted together. Thus, at least two elongated carriers may be wound about or around each other, possibly in a plurality of windings. The at least two elongated carriers may be mutually wound about or around each other relatively loosely, or relatively tightly. The at least two elongated carriers may be twisted together relatively loosely so as to facilitate forming the at least one opening between at least portions of the at least two elongated carriers. According to another example, one or more of the at least two elongated carriers may be wound about one or more other ones of the at least two elongated carriers, possibly in a plurality of windings, wherein the one or more other ones of the at least two elongated carriers may not be wound about the one of the at least two elongated carriers (i.e. the former one(s)). The one or more other ones of the at least two elongated carriers may

hence not have a wound shape, whereas the one of the at least two elongated carriers (i.e. the former one(s)) may have a wound shape. The one or more of the at least two elongated carriers may be wound about the one or more other ones of the at least two elongated carriers relatively loosely, so as to facilitate forming the at least one opening between at least portions of the at least two elongated carriers.

As described in the foregoing, the first electrical interconnection element and the second electrical interconnection element may – in addition or in alternative to being configured to electrically interconnect the first electrical device and the second electrical device by means of inductive coupling – be configured to electrically interconnect the first electrical device and the second electrical device by means of capacitive coupling. To that end, the at least one elongated carrier of the first electrical device may comprise at least one first electrode element and the second electrical device may comprise at least one second electrode element. The at least one first electrode element may be included in or constitute the first electrical interconnection element of the first electrical device, and the at least one second electrode element may be included in or constitute the second electrical interconnection element of the second electrical device. The at least one elongated carrier of the first electrical device and the second electrical device may be arranged in relation to each other such that a capacitive impedance between the at least one first electrode element and the at least one second electrode element is created. By means of the capacitive impedance, an electrical interconnection between the first electrical device and the second electrical device by means of capacitive coupling may be facilitated or enabled.

The at least one elongated carrier of the first electrical device may be flexible and/or foldable. The second electrical device may comprise at least one elongated carrier that is flexible and/or foldable. The at least one first electrode element may be comprised in at least one portion of the at least one elongated carrier of the first electrical device, and the at least one second electrode element may be comprised in at least one portion of the at least one elongated carrier of the second electrical device. The at least one elongated carrier of the first electrical device and the at least one elongated carrier of the second electrical device may be folded and arranged relatively to each other in a succession such that the at least one portion of the at least one elongated carrier of the first electrical device and the at least one portion of the at least one elongated carrier of the second electrical device become parallel, or substantially parallel, with respect to each other. Thereby, the at least one first electrode element and the at least one second electrode element may be arranged parallel, or substantially parallel, with respect to each other, which may facilitate creating a capacitive

impedance between the at least one first electrode element and the at least one second electrode element.

The at least one first electrode element may be comprised in a plurality of portions of the at least one elongated carrier of the first electrical device, and the at least one second electrode element may be comprised in a plurality of portions of the at least one elongated carrier of the second electrical device. There may possibly be a plurality of first electrode elements, each of which may be comprised in a respective one of the plurality of portions of the at least one elongated carrier of the first electrical device. Similarly, there may possibly be a plurality of second electrode elements, each of which may be comprised in a respective one of the plurality of portions of the at least one elongated carrier of the second electrical device.

The efficiency in the capacitive coupling in the electrical interconnection between the first electrical device and the second electrical device may be increased by folding the at least one elongated carrier of the first electrical device and the second electrical device. To that end, the at least one elongated carrier of the first electrical device and the at least one elongated carrier of the second electrical device may be folded and arranged relatively to each other in a succession such that portions of the at least one elongated carrier of the first electrical device and portions of the at least one elongated carrier of the second electrical device are arranged alternatingly in the succession. That is, a portion of the at least one elongated carrier of the first electrical device may be followed in the succession by a portion of the at least one elongated carrier of the second electrical device, which in turn may be followed in the succession by a portion of the at least one elongated carrier of the first electrical device, and so on.

As mentioned in the foregoing, the at least one elongated carrier of the first electrical device may be flexible and/or foldable.

The at least one elongated carrier may comprise at least one electrical conductor which may extend in or on at least a first portion of the at least one elongated carrier and a second portion of the at least one elongated carrier. The first portion of the at least one elongated carrier and the second portion of the at least one elongated carrier may for example be adjoining portions of the at least one elongated carrier. The at least one electrical conductor may be arranged such that when the first portion of the at least one elongated carrier is folded over the second portion of the at least one elongated carrier so that the first portion of the at least one elongated carrier is parallel, or substantially parallel, to the second portion of the at least one elongated carrier, at least a portion of the at least one electrical

conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier forms a coil element. The coil element may have one or more windings, possibly one or more complete or full windings and a partially completed winding. In general, the more windings the coil element has, the more effective the inductive coupling efficiency in the electrical interconnection between the first electrical device and the second electrical device may become. The coil element may be included in or constitute the first electrical interconnection element of the first electrical device.

Possibly, the at least one electrical conductor may extend in or on a plurality of portions of the elongated carrier, at least some of which portions may be adjoining so as to together define a coherent portion of the at least one elongated carrier. The at least one electrical conductor may be arranged such that when the at least one elongated carrier is folded so that the plurality of portions are parallel (or substantially parallel) with respect to each other, at least a portion of the at least one electrical conductor in the plurality of portions of the elongated carrier forms a coil element, which may have a plurality of windings.

For example, at least a portion of the at least one electrical conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier may form a coil element having a first winding (which may be a complete or full winding) and at least a second winding (which may be a complete or full winding or a partially completed or full winding full). The at least a portion of the at least one electrical conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier may be arranged such that the direction of current in the different windings of the coil element is the same. By the direction of current in the different windings of the coil element being the same, a relatively high efficiency in the inductive coupling in the electrical interconnection between the first electrical device and the second electrical device may be achieved.

The at least one elongated carrier may comprise at least one opening therein, which may extend between a first side of the at least one elongated carrier and a second side of the at least one elongated carrier. The at least one elongated carrier may comprise at least one electrical conductor extending in or on at least a portion of the at least one elongated carrier. The at least one electrical conductor may be arranged so as to extend about the at least one opening so as to form a coil element about the at least one opening. The coil element may be included in or constitute the first electrical interconnection element of the first electrical device.

As mentioned in the foregoing, the at least one elongated carrier may be flexible. A portion of the at least one elongated carrier may be arranged in a rolled-up arrangement having a central through-hole. The at least one elongated carrier may comprise at least one electrical conductor extending in or on at least the portion of the at least one elongated carrier arranged that is in a rolled-up arrangement so as to form a coil element about the central through-hole. The coil element may be included in or constitute the first electrical interconnection element of the first electrical device.

The first electrical device may comprise at least two elongated carriers. Each of the at least two elongated carriers may be flexible. Each of the at least two elongated carriers may comprise at least one electrical conductor extending in or on at least a portion of the elongated carrier. The electrical conductors of the at least two elongated carriers may be arranged such that the direction of current in at least two of the electrical conductors is opposite to each other. The at least two elongated carriers may be in a wound relation with respect to each other at least at the respective portions of the elongated carrier in which at least one electrical conductor extends such that at least one opening between at least portions of the at least two elongated carriers is formed, whereby the at least portions of the at least two elongated carriers form a coil element about the at least one opening. The coil element may be included in or constitute the first electrical interconnection element of the first electrical device.

As mentioned in the foregoing, the at least one elongated carrier of the first electrical device may for example comprise a strip (e.g., a light strip), such as, for example, a LED strip, which for example may comprise one or more flexible PCBs and/or flexfoils. The strip may be covered by a conformal coating made or encapsulated by a sleeve for example made of Silicone of Polyurethane or a similar material. It has been found by the inventors that by embedding particles or pieces of ferrites or a similar material in the strip before covering or over-molding the strip with Silicone or Polyurethane or a similar material, the magnetic coupling efficiency between the first electrical interconnection element and the second electrical interconnection element may be increased, which in turn may facilitate or allow for achieving a relatively high inductive coupling efficiency in an electrical interconnection between the first electrical device and the second electrical device.

The coil element(s) described in the foregoing, which may be included in or constitute the first electrical interconnection element of the first electrical device, may advantageously be used to daisy chain different first electrical devices, such as light strips

(e.g., LED strips), i.e., to electrically interconnect several first electrical devices such as light strips in a sequence.

Further objects and advantages of the present invention are described in the following by means of exemplifying embodiments. It is noted that the present invention relates to all possible combinations of features recited in the claims. Further features of, and advantages with, the present invention will become apparent when studying the appended claims and the description herein. Those skilled in the art realize that different features of the present invention can be combined to create embodiments other than those described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplifying embodiments of the invention will be described below with reference to the accompanying drawings.

Figs. 1 and 2 are schematic circuit diagrams illustrating principles of embodiments of the present invention.

Fig. 3 is a schematic side view of a part of an elongated carrier of a first electrical device in accordance with an embodiment of the present invention.

Fig. 4 is a schematic view from the above of a part of an elongated carrier of a first electrical device in accordance with an embodiment of the present invention.

Fig. 5 is a schematic view from the above of a part of an elongated carrier of a first electrical device in accordance with another embodiment of the present invention.

Fig. 6 is a schematic view from the above of the elongated carrier illustrated in Figure 5, in which the elongated carrier has been folded.

Fig. 7 is a schematic side view of a part of an elongated carrier of a first electrical device in accordance with an embodiment of the present invention.

Fig. 8 is a schematic side view of parts of two elongated carriers of a first electrical device in accordance with an embodiment of the present invention.

Fig. 9 is a schematic side view from the above of the parts of the elongated carriers illustrated in Figure 8.

Figs. 10 to 12 are schematic view of lighting arrangements according to embodiments of the present invention.

All the figures are schematic, not necessarily to scale, and generally only show parts which are necessary in order to elucidate embodiments of the present invention, wherein other parts may be omitted or merely suggested.

DETAILED DESCRIPTION

The present invention will now be described hereinafter with reference to the accompanying drawings, in which exemplifying embodiments of the present invention are shown. The present invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments of the present invention set forth herein; rather, these embodiments of the present invention are provided by way of example so that this disclosure will convey the scope of the invention to those skilled in the art. In the drawings, identical reference numerals denote the same or similar components having a same or similar function, unless specifically stated otherwise.

Figures 1 and 2 are schematic circuit diagrams illustrating principles of embodiments of the present invention. Each of Figures 1 and 2 illustrates a lighting arrangement 100 comprising a first electrical device 10 and a second electrical device 20. Although not illustrated in Figures 1 and 2, the first electrical device 10 comprises at least one elongated carrier (not shown in Figures 1 and 2) arranged to support at least one light-emitting element. The at least one elongated carrier is configured to provide power to the at least one light-emitting element. The second electrical device 20 is configured to supply power to the first electrical device 10. To that end, the second electrical device 20 may for example comprise, or be connected to, a power source 25, e.g., an Alternating Current (AC) power source 25 as indicated in Figures 1 and 2.

The at least one elongated carrier of the first electrical device 10 comprises a first electrical interconnection element, and the second electrical device 20 comprises a second electrical interconnection element. The first electrical interconnection element and the second electrical interconnection element are configured to electrically interconnect the first electrical device 10 and the second electrical device 20 by means of inductive coupling, as illustrated in Figure 1, or capacitive coupling, as illustrated in Figure 2. It is to be understood that the first electrical interconnection element and the second electrical interconnection element may be configured to electrically interconnect the first electrical device 10 and the second electrical device 20 by means of a combination of inductive coupling and capacitive coupling.

In Figure 1, the first electrical interconnection element is exemplary illustrated by windings of a coil element 11, and the second electrical interconnection element is exemplary illustrated by a winding of a coil element 21. The coil element 11 may be included or incorporated in the at least one elongated carrier of the first electrical device 10. The lighting arrangement in Figure 1 comprises a magnetic element 22 in the form of a magnetic

core. The magnetic element 22 may be considered to be included in one or both of the first electrical interconnection element and the second electrical interconnection element. As illustrated in Figure 1, the magnetic element 22 may for example be included in the second electrical interconnection element. The coil elements 11 and 21 may together with the magnetic element 22 form a transformer arrangement facilitating or allowing for inductive power transfer between the first electrical device 10 and the second electrical device 20. By the first electrical interconnection element and the second electrical interconnection element being configured to electrically interconnect the first electrical device 10 and the second electrical device 20 by means of inductive coupling, there may be facilitated or enabled for the second electrical device 20 to supply power (e.g., from the power source 25) to the at least one elongated carrier of the first electrical device 10 by means of inductive power transfer between the second electrical interconnection element and the first electrical interconnection element, which power for example may be provided to the at least one light-emitting element supported by the at least one elongated carrier of the first electrical device 10, which at least one light-emitting element is schematically indicated at 12 in Figure 1.

In Figure 2, the first electrical interconnection element is exemplary illustrated by first electrode elements 13, 14, and the second electrical interconnection element is exemplary illustrated by second electrode elements 23, 24. The electrode elements 13, 14 may be included or incorporated in the at least one elongated carrier of the first electrical device 10. The first electrical device 10, or the at least one elongated carrier of the first electrical device 10, and the second electrical device 20 are arranged in relation to each other such that a capacitive impedance between the first electrode element 13 and the second electrode element 23 and between the first electrode element 14 and the second electrode element 24 is created. By the first electrical interconnection element and the second electrical interconnection element being configured to electrically interconnect the first electrical device 10 and the second electrical device 20 by means of capacitive coupling, there may be facilitated or enabled for the second electrical device 20 to supply power (e.g., from the power source 25) to the at least one elongated carrier of the first electrical device 10 by means of capacitive power transfer between the second electrical interconnection element and the first electrical interconnection element, which power for example may be provided to the at least one light-emitting element supported by the at least one elongated carrier of the first electrical device 10, which at least one light-emitting element is schematically indicated at 12 in Figure 2.

The at least one elongated carrier of the first electrical device 10 may for example comprise one or more flexible PCBs and/or one or more flexfoils configured to support the at least one light-emitting element 12 and configured to provide power to the at least one light-emitting element 12. The at least one elongated carrier of the first electrical device 10 may for example comprise a strip (e.g., a light strip), such as, for example, a LED strip.

The second electrical device 20 may be similar to the first electrical device 10, and may like the first electrical device 10 comprise at least one elongated carrier (not shown in Figures 1 and 2), such as, for example, a LED strip, arranged to support at least one light-emitting element (not shown in Figures 1 and 2) and configured to provide power to the at least one light-emitting element. In addition, or in alternative, the second electrical device 20 may comprise a driver (or driver circuitry) for controlling operation of the at least one light-emitting element of the at least one elongated carrier of the first electrical device 10. The at least one light-emitting element of the at least one elongated carrier of the first electrical device 10 may hence be electronically controllable.

With reference to Figures 3 to 12 which will be described in the following, the at least one elongated carrier of the first electrical device 10 and the second electrical device 20 are illustrated in the figures as being constituted by light strips, such as, for example, LED strips. It is however to be understood that this is according to an example and that another or other types of elongated carriers are possible. Also, the second electrical device 20 does not necessarily have to include an elongated carrier, such as indicated in the foregoing.

Figure 3 is a schematic side view of a part of an elongated carrier 15 of a first electrical device 10 in accordance with an embodiment of the present invention. The elongated carrier 15 is flexible and foldable. Figure 3 illustrates the elongated carrier 15 in a state in which the elongated carrier 15 has been folded such that portions 16, 17, 18 thereof become parallel (or substantially parallel) with each other and arranged in a succession, possibly in a stacked configuration. To this end, the elongated carrier 15 has been folded at folding lines schematically indicated in Figure 3 at 31 and 32, which folding lines 31 and 32 may extend from one side of the elongated carrier 15 to the other side of the elongated carrier 15 and which may be perpendicular (or substantially perpendicular) to an axis along which the elongated carrier 15 extends.

Figure 4 is a schematic view from the above of a part of an elongated carrier 15 of a first electrical device 10 in accordance with an embodiment of the present invention. Like the elongated carrier 15 of the first electrical device 10 illustrated in Figure 3, the

elongated carrier 15 of the first electrical device 10 illustrated in Figure 4 is flexible and foldable. The elongated carrier 15 comprises an electrical conductor 19 extending in or on at least a first portion 16 of the elongated carrier 15 and a second portion 17 of the elongated carrier 15. The electrical conductor 15 is arranged such that when the first portion 16 of the elongated carrier 15 is folded over the second portion 17 of the elongated carrier 15 so that the first portion 16 of the elongated carrier 15 becomes parallel to the second portion 17 of the elongated carrier 15, at least a portion of the electrical conductor 19 in the first portion 16 of the elongated carrier 15 and in the second portion 17 of the elongated carrier 15 forms a coil element. The coil element may be included in or constitute the first electrical interconnection element of the first electrical device 10 described with reference to Figure 1.

The first portion 16 of the elongated carrier 15 and a second portion 17 of the elongated carrier 15 are separated by a folding line 31 along which the elongated carrier 15 may be folded, which folding line 31 extends from one side of the elongated carrier 15 to the other side of the elongated carrier 15 and which is perpendicular (or substantially perpendicular) to an axis along which the elongated carrier 15 extends. In accordance with the embodiment of the present invention illustrated in Figure 4, the thus formed coil element may have a first winding and second winding, wherein the portion of the electrical conductor 19 in the first portion 16 of the elongated carrier 15 and in the second portion 17 of the elongated carrier 15 are arranged such that direction of current in the different windings of the coil element is the same. Thereby, the direction of current in the different windings of the coil element may be in-phase, and not out-of-phase.

As indicated in Figure 4, the electrical conductor 19 of the elongated carrier 15 of the first electrical device 10 may be required or desired to cross at one or more locations. In the illustrated embodiment of the present invention and in one or more other embodiments of the present invention, this may for example be implemented or realized by means of employing multi-layer flexible PCB(s) or multi-layer flexfoil for realizing the elongated carrier 15, or by means of employing so called zero-ohm resistors or zero-ohm links on or in the elongated carrier 15.

Figure 5 is a schematic view from the above of a part of an elongated carrier 15 of a first electrical device in accordance with an embodiment of the present invention. Like the elongated carrier 15 of the first electrical devices illustrated in Figures 3 and 4, the elongated carrier 15 of the first electrical device illustrated in Figure 5 is flexible and foldable. The elongated carrier 15 comprises an electrical conductor 19 extending in or on at least a portion of the elongated carrier 15.

In accordance with the embodiment of the present invention illustrated in Figure 5, the elongated carrier 15 comprises a plurality of openings 35 therein, extending between a first side (e.g., a bottom side) of the elongated carrier 15 and a second side (e.g., a top side) of the elongated carrier 15. The elongated carrier 15 comprises an electrical conductor 19 extending in or on at least a portion of the elongated carrier 15. As illustrated in Figure 5, the electrical conductor 19 is arranged so as to extend at least in part about the respective ones of the openings 35 so as to form a coil element about the respective ones of the openings 35. With reference to Figure 1, the coil elements may be included in or constitute the first electrical interconnection element of the first electrical device 10. The first electrical interconnection element of the first electrical device 10 and/or the second electrical interconnection element of the second electrical device 20 may comprise at least one magnetic element extending through one or more of the openings 35.

Further in accordance with the embodiment of the present invention illustrated in Figure 5, the elongated carrier 15 comprises portions 41 to 45, each of which comprises one of the openings 35. The different portions 41 to 45 of the elongated carrier 15 are separated by folding lines 51 to 54 along which the elongated carrier 15 may be folded. Each of the folding lines 51 to 54 extends from one side of the elongated carrier 15 to the other side of the elongated carrier 15 and is perpendicular (or substantially perpendicular) to an axis along which the elongated carrier 15 extends.

Figure 6 is a schematic view from the above of the elongated carrier 15 illustrated in Figure 5 in which it has been folded. As illustrated in Figure 6, the elongated carrier 15 may be folded, e.g., at one or more of the folding lines 51 to 54, such that two or more of the portions 41 to 45 of the elongated carrier 15 become arranged relatively to each other in a succession (possibly in a stacked configuration) and such that the two or more of the portions 41 to 45 of the elongated carrier 15 become parallel with respect to each other. And as further illustrated in Figure 6, the elongated carrier 15 may be folded such that the openings in the respective ones of the two or more of the portions 41 to 45 of the elongated carrier 15 which are folded over each other coincide or overlie each other, thereby forming an opening through the succession of folded portions. As illustrated in Figure 6 and with reference to Figure 1, the first electrical interconnection element of the first electrical device 10 and/or the second electrical interconnection element of the second electrical device 20 may comprise at least one magnetic element 22 extending through the opening through the succession of folded portions. The magnetic element 22 may for example comprise a magnetic core, e.g., a ferrite core.

As indicated in Figures 5 and 6, the electrical conductor 19 of the elongated carrier 15 may be arranged so as to form a closed circuit. To that end, the elongated carrier 15 may possibly comprise a return line, or return conductor (not shown in Figures 5 and 6), connected to the electrical conductor 19 (or forming a part thereof) so as to form a closed circuit for current flowing therein. The return line or conductor may not necessarily be a part or portion of the electrical conductor 19, but it could for example be a separate wire or other type of conductor that may interconnect two ends of the electrical conductor 19.

Figure 7 is a schematic side view of a part of an elongated carrier 15 of a first electrical device in accordance with an embodiment of the present invention. Like the elongated carriers 15 of the first electrical devices illustrated in Figures 3 to 6, the elongated carrier 15 of the first electrical device illustrated in Figure 7 is flexible. As illustrated in Figure 7, a portion of the elongated carrier 15 is arranged in a rolled-up arrangement 60 having a through-hole 61, e.g., a central through-hole. The elongated carrier 15 may comprise at least one electrical conductor (not shown in Figure 7) extending in or on at least the portion of the elongated carrier 15 that is arranged in the rolled-up arrangement 60 so as to form a coil element (not shown in Figure 7) about the central through-hole 61. With reference to Figure 1, the coil element may be included in or constitute the first electrical interconnection element of the first electrical device 10. The first electrical interconnection element of the first electrical device 10 and/or the second electrical interconnection element of the second electrical device 20 may comprise at least one magnetic element extending through the central through-hole 61. The at least one magnetic element may for example comprise a magnetic core.

Figure 8 is a schematic side view of parts of two elongated carriers 71, 72 of a first electrical device 10 in accordance with an embodiment of the present invention. Figure 9 is a schematic side view from the above of the parts of the elongated carriers 71, 72 illustrated in Figure 8. Each of the elongated carriers 71 and 72 is flexible. Each of the two elongated carriers 71, 72 comprises at least one electrical conductor (not shown in Figures 8 and 9) which extends in or on at least a portion of the elongated carrier 71, 72. The electrical conductors of the elongated carriers 71, 72 are arranged such that the direction of current in the electrical conductors (e.g., in electrical conductors in different ones of the elongated carriers 71, 72) is opposite to each other. For example, the electrical conductors of the elongated carriers 71, 72 may extend along the length of the respective elongated carriers 71, 72. The arrows in Figure 8 indicate the general direction of current in the electrical conductors of the respective ones of the elongated carriers 71, 72.

As illustrated in Figures 8 and 9, the elongated carriers 71, 72 are in a wound relation with respect to each other, at least at the respective portions of the elongated carriers 71, 72 in which at least one electrical conductor extends, such that openings 75 between at least portions of the elongated carriers 71, 72 are formed. Thereby, the respective portions of the elongated carriers 71, 72 in or on which at least one electrical conductor extends (or the at least one electrical conductor extending in or on the respective portions of the elongated carriers 71, 72) may form coil elements about the openings 75. The elongated carrier 71 and/or the elongated carrier 72 may be wound with respect to each other relatively loosely, so as to facilitate forming the openings 75 between at least portions of the elongated carriers 71, 72. With further reference to Figure 1, the coil elements may be included in or constitute the first electrical interconnection element of the first electrical device 10. The first electrical interconnection element of the first electrical device 10 and/or the second electrical interconnection element of the second electrical device 20 may comprise at least one magnetic element extending through the openings 75. An example of such a magnetic element is illustrated in Figure 8 in the form of a magnetic element 22 comprising a base portion 27 and two legs 28, 29 extending from the base portion 27. The magnetic element 22 may for example comprise a so called "U" core, e.g., an "U" ferrite core. The magnetic element 22 may be arranged such that its legs 28, 29 extend through the openings 75. Figure 9 illustrates a state in which the magnetic element 22 is arranged such that its legs 28, 29 extend through the openings 75.

Figures 10 to 12 are schematic views of lighting arrangements 100 according to embodiments of the present invention. Each of the lighting arrangements 100 comprises a first electrical device and a second electrical device, for example such as illustrated in Figure 2.

According to the embodiments of the present invention illustrated in Figures 11 and 12, the first electrical device comprises an elongated carrier 15 that is flexible and/or foldable, and the second electrical device comprises elongated carrier 85 that is flexible and/or foldable. In the lighting arrangement 100 illustrated in Figure 10, the first electrical device also comprises an elongated carrier 15 and the second electrical device also comprises elongated carrier 85, but it is not required that the elongated carriers 15, 85 of the lighting arrangement 100 illustrated in Figure 10 are flexible and/or foldable, although one or both of them could be flexible and/or foldable.

With reference to Figure 10, the elongated carrier 15 comprises a first electrode element (not shown in Figure 10), which in accordance with the illustrated

embodiment of the present invention may be arranged in an end portion 91 of the elongated carrier 15 (or possibly in another portion of the elongated carrier 15). Similarly, the elongated carrier 15 comprises a second electrode element (not shown in Figure 10), which in accordance with the illustrated embodiment of the present invention may be arranged in an end portion 92 of the elongated carrier 85 (or possibly in another portion of the elongated carrier 85). The elongated carrier 15 and the elongated carrier 85 may be arranged such that the at first electrode element and the second electrode element may be arranged parallel, or substantially parallel, with respect to each other, which may facilitate creating a capacitive impedance between the first electrode element and the second electrode element. For example, in accordance with the embodiment of the present invention illustrated in Figure 10, the end portions 91 and 92 of the elongated carriers 15 and 85, respectively, in which the first electrode element and the second electrode element, respectively, are arranged, may be arranged so as to be parallel, or substantially parallel, with respect to each other.

Possibly, the first electrode element may be comprised in a plurality of portions of the elongated carrier 15 of the first electrical device, and the second electrode element may be comprised in a plurality of portions of the elongated carrier 85 of the second electrical device. In alternative or in addition, the elongated carrier 15 may comprise a plurality of first electrode elements, each of which is comprised in a respective one of the plurality of portions of the elongated carrier 85, and similarly, the elongated carrier 85 may comprise a plurality of second electrode elements, each of which is comprised in a respective one of the plurality of portions of the elongated carrier 85. As illustrated in Figure 11, the elongated carrier 15 may comprise two such portions 91 and 93, and the elongated carrier 85 may comprise two such portions 92 and 94. The elongated carriers 15, 85 may include more than two such portions. As illustrated in Figure 12, the elongated carrier 15 may for example comprise three such portions 91, 93 and 95, and the elongated carrier 85 may for example comprise three such portions 92, 94 and 96. The elongated carrier 15 and the elongated carrier 85 may be folded and arranged relatively to each other in a succession such that the portions 91 and 93 of the elongated carrier 15 and the portions 92 and 94 of the elongated carrier 85 are arranged alternatingly in the succession, such as illustrated in Figure 11. Similarly, the elongated carrier 15 and the elongated carrier 85 may be folded and arranged relatively to each other in a succession such that the portions 91, 93 and 95 of the elongated carrier 15 and the portions 92, 94 and 96 of the elongated carrier 85 are arranged alternatingly in the succession, such as illustrated in Figure 12. Each of the elongated carriers 15, 85 may include more than three such portions, which similarly to Figures 11 and 12 may

be arranged relatively to each other in a succession such that the portions of the elongated carrier 15 and the portions of the elongated carrier 85 are arranged alternatingly in the succession. The efficiency in a capacitive coupling in the electrical interconnection between the first electrical device and the second electrical device may in this manner be increased by folding the elongated carrier of the first electrical device and the elongated carrier of the second electrical device.

In conclusion a lighting arrangement is disclosed, comprising a first electrical device, comprising at least one elongated carrier arranged to support at least one light-emitting element. The at least one elongated carrier may be configured to provide power to the at least one light-emitting element. The lighting arrangement comprises a second electrical device, which may be configured to supply power to the first electrical device. The at least one elongated carrier of the first electrical device comprises a first electrical interconnection element and the second electrical device comprises a second electrical interconnection element. The first electrical interconnection element and the second electrical interconnection element are configured to electrically interconnect the first electrical device and the second electrical device by means of at least one of inductive coupling or capacitive coupling.

While the present invention has been illustrated in the appended drawings and the foregoing description, such illustration is to be considered illustrative or exemplifying and not restrictive; the present invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the appended claims, the word “comprising” does not exclude other elements or steps, and the indefinite article ”a” or “an” does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. A lighting arrangement (100) comprising:

a first electrical device (10) comprising at least one elongated carrier (15; 71, 72) arranged to support at least one light-emitting element (12), the at least one elongated carrier being configured to provide power to the at least one light-emitting element; and

a second electrical device (20);

the at least one elongated carrier of the first electrical device comprising a first electrical interconnection element (11; 13, 14) and the second electrical device comprising a second electrical interconnection element (21; 23, 24), wherein the first electrical interconnection element and the second electrical interconnection element are configured to electrically interconnect the first electrical device and the second electrical device by means of at least one of inductive coupling or capacitive coupling

wherein, in case of inductive coupling, the at least one elongated carrier of the first electrical device comprises at least one opening (35) in the at least one elongated carrier extending between a first side of the at least one elongated carrier and a second side of the at least one elongated carrier, wherein at least one of the first electrical interconnection element of the first electrical device or the second electrical interconnection element of the second electrical device comprises at least one magnetic element (22) extending through the at least one opening in the at least one elongated carrier of the first electrical device, wherein the at least one elongated carrier of the first electrical device comprises at least one electrical conductor extending in or on at least a portion of the elongated carrier and being arranged so as to extend around the at least one opening so as to form a coil element about the at least one opening, the coil element being included in or constituting the first electrical interconnection element of the first electrical device, or

wherein, in case of inductive coupling, the at least one elongated carrier of the first electrical device is flexible, and wherein a portion of the at least one elongated carrier is arranged in a rolled-up arrangement (60) having a central through-hole (61), wherein the at least one elongated carrier of the first electrical device comprises at least one electrical conductor extending in or on at least the portion of the elongated carrier that is arranged in a rolled-up arrangement so as to form a coil element about the central through-hole, the coil

element being included in or constituting the first electrical interconnection element of the first electrical device, and wherein at least one of the first electrical interconnection element of the first electrical device or the second electrical interconnection element of the second electrical device comprises at least one magnetic element extending through the central through-hole, or

wherein, in case of inductive coupling, the first electrical device comprises at least two elongated carriers (71, 72), each of the at least two elongated carriers being flexible and comprising at least one electrical conductor extending in or on at least a portion of the elongated carrier, wherein the electrical conductors of the at least two elongated carriers are arranged such that the direction of current in at least two of the electrical conductors is opposite to each other, wherein the at least two elongated carriers are in a wound relation with respect to each other at least at the respective portions of the elongated carriers in which at least one electrical conductor extends such that at least one opening (75) is formed between at least portions of the at least two elongated carriers, whereby the at least portions of the at least two elongated carriers form a coil element about the at least one opening, the coil element being included in or constituting the first electrical interconnection element of the first electrical device, and wherein at least one of the first electrical interconnection element of the first electrical device or the second electrical interconnection element of the second electrical device comprises at least one magnetic element (22) extending through the at least one opening, or

wherein, in case of capacitive coupling, the at least one elongated carrier of the first electrical device comprises at least one first electrode element (13, 14) and the second electrical device comprises at least one second electrode element (23, 24), wherein the at least one first electrode element is included in or constituting the first electrical interconnection element (13, 14) of the first electrical device and the at least one second electrode element is included in or constituting the second electrical interconnection element (23, 24) of the second electrical device, wherein the at least one elongated carrier of the first electrical device and the second electrical device are arranged in relation to each other such that a capacitive impedance between the at least one first electrode element and the at least one second electrode element is created.

2. A lighting arrangement according to claim 1, in case of capacitive coupling, wherein the at least one elongated carrier of the first electrical device is foldable, and wherein the second electrical device comprises at least one elongated carrier that is foldable, wherein

the at least one first electrode element is comprised in at least one portion of the at least one elongated carrier of the first electrical device, and wherein the at least one second electrode element is comprised in at least one portion of the at least one elongated carrier of the second electrical device, wherein the at least one elongated carrier of the first electrical device and the at least one elongated carrier of the second electrical device are folded and arranged relatively to each other in a succession such that the at least one portion of the at least one elongated carrier of the first electrical device and the at least one portion of the at least one elongated carrier of the second electrical device become parallel with respect to each other.

3. A lighting arrangement according to claim 2, wherein the at least one first electrode element is comprised in a plurality of portions of the at least one elongated carrier of the first electrical device and the at least one second electrode element is comprised in a plurality of portions of the at least one elongated carrier of the second electrical device, wherein the at least one elongated carrier of the first electrical device and the at least one elongated carrier of the second electrical device are folded and arranged relatively to each other in a succession such that portions of the at least one elongated carrier of the first electrical device and portions of the at least one elongated carrier of the second electrical device are arranged alternatingly in the succession.

4. A lighting arrangement according to any of the preceeding claims, wherein the second electrical device comprises at least one of:

at least one elongated carrier (85) arranged to support at least one light-emitting element and configured to provide power to the at least one light-emitting element; or

driver circuitry for controlling operation of the at least one light-emitting element of the at least one elongated carrier of the first electrical device, wherein the at least one light-emitting element of the at least one elongated carrier of the first electrical device is electronically controllable.

5. A first electrical device (10) comprising at least one elongated carrier (15; 71, 72) arranged to support at least one light-emitting element (12) and configured to provide power to the at least one light-emitting element, wherein the first electrical device is configured to be used in conjunction with a lighting arrangement (100) according to any one of claims 1-4.

6. A first electrical device according to claim 5 in case of inductive coupling, wherein the at least one elongated carrier is foldable, and wherein the at least one elongated carrier comprises at least one electrical conductor (19) extending in or on at least a first portion of the at least one elongated carrier and a second portion of the at least one elongated carrier, wherein the at least one electrical conductor is arranged such that when the first portion (15) of the at least one elongated carrier is folded over the second portion (16) of the at least one elongated carrier so that the first portion of the at least one elongated carrier is parallel to the second portion of the at least one elongated carrier, at least a portion of the at least one electrical conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier forms a coil element, the coil element being included in or constituting the first electrical interconnection element of the first electrical device.

7. A first electrical device according to claim 6, wherein at least a portion of the at least one electrical conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier form a coil element having a first winding and at least a second winding, wherein the at least a portion of the at least one electrical conductor in the first portion of the at least one elongated carrier and in the second portion of the at least one elongated carrier are arranged such that direction of current in the different windings of the coil element is the same.

8. A first electrical device according to any one of claims 5-7 in case of inductive coupling, wherein the at least one elongated carrier comprises at least one opening (35) therein extending between a first side of the at least one elongated carrier and a second side of the at least one elongated carrier, wherein the at least one elongated carrier comprises at least one electrical conductor (19) extending in or on at least a portion of the at least one elongated carrier, wherein the at least one electrical conductor is arranged so as to extend about the at least one opening so as to form a coil element about the at least one opening, the coil element being included in or constituting the first electrical interconnection element of the first electrical device.

9. A first electrical device according to any one of claims 5-8 in case of inductive coupling, wherein the at least one elongated carrier is flexible, and wherein a portion of the at

least one elongated carrier is arranged in a rolled-up arrangement (60) having a central through-hole (61), wherein the at least one elongated carrier comprises at least one electrical conductor extending in or on at least the portion of the at least one elongated carrier arranged that is in a rolled-up arrangement so as to form a coil element about the central through-hole, the coil element being included in or constituting the first electrical interconnection element of the first electrical device.

10. A first electrical device according to any one of claims 5-9 in case of inductive coupling, comprising at least two elongated carriers (71, 72), each of the at least two elongated carriers being flexible, each of the at least two elongated carriers comprising at least one electrical conductor extending in or on at least a portion of the elongated carrier, wherein the electrical conductors of the at least two elongated carriers are arranged such that the direction of current in at least two of the electrical conductors is opposite to each other, wherein the at least two elongated carriers are in a wound relation with respect to each other at least at the respective portions of the elongated carrier in which at least one electrical conductor extends such that at least one opening (75) between at least portions of the at least two elongated carriers is formed, whereby the at least portions of the at least two elongated carriers form a coil element about the at least one opening, the coil element being included in or constituting the first electrical interconnection element of the first electrical device.

11. A first electrical device according to any one of claims 5-10, wherein the at least one elongated carrier comprises at least one strip, and wherein the at least one light-emitting element comprises at least one light-emitting diode.

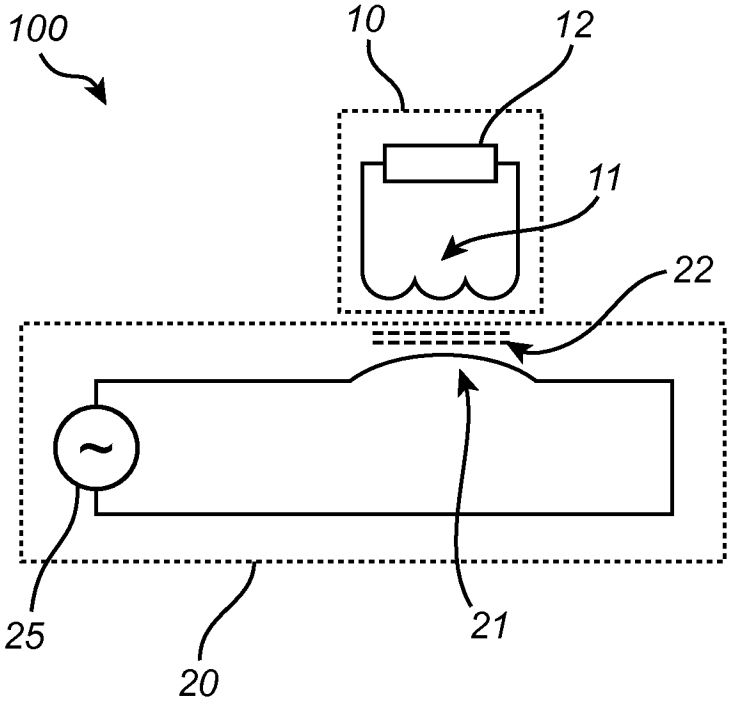

Fig. 1

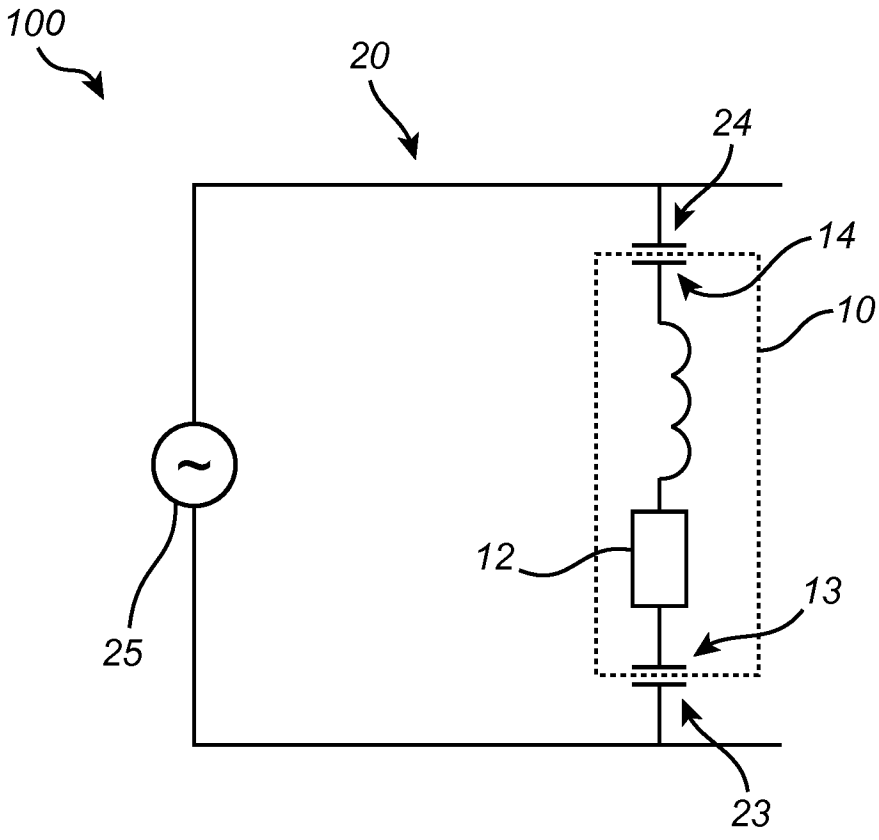

Fig. 2

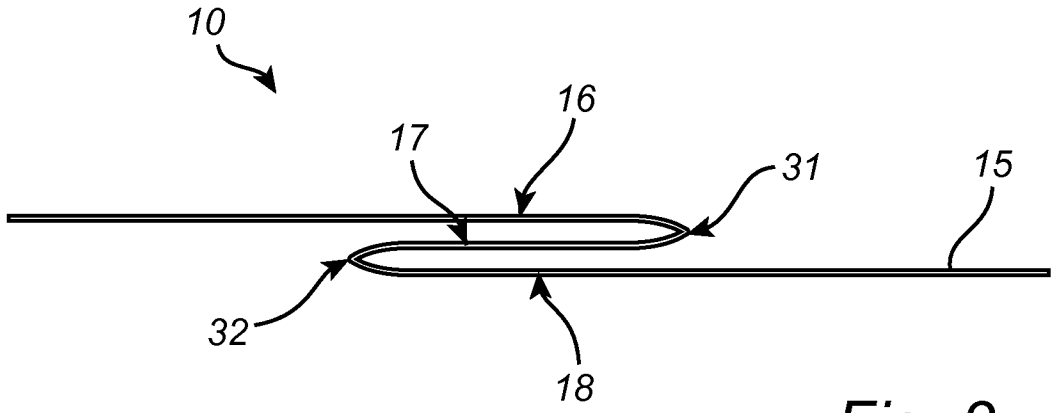

Fig. 3

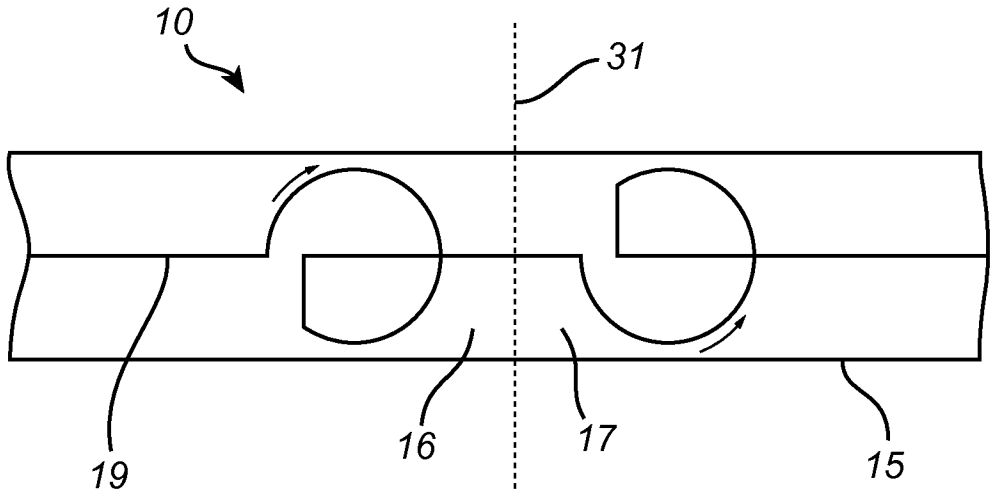

Fig. 4

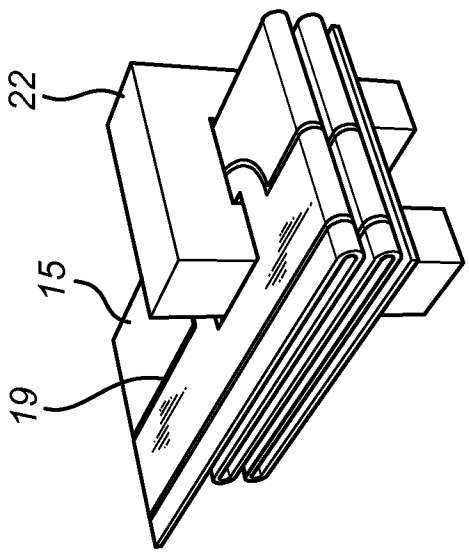

Fig. 6

Fig. 5

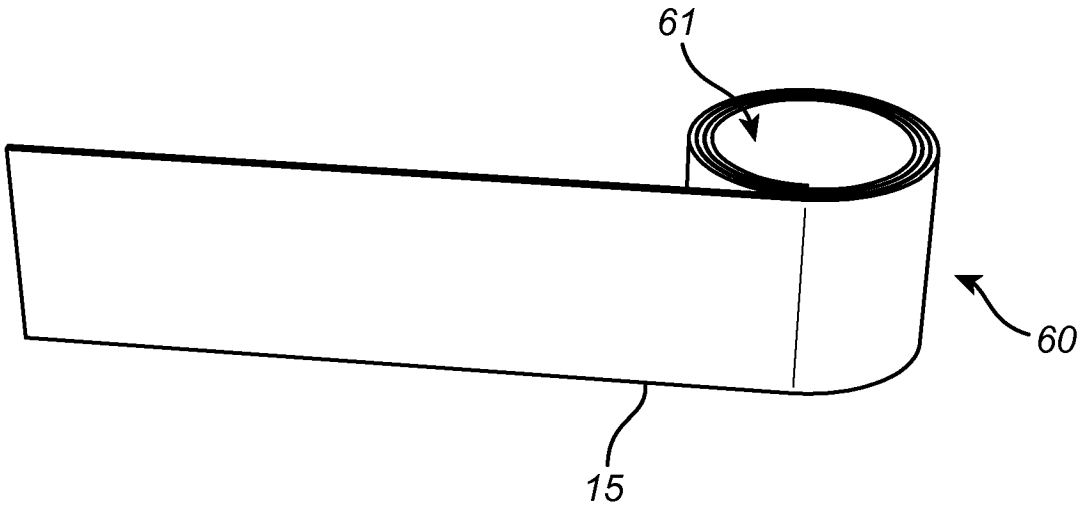

Fig. 7

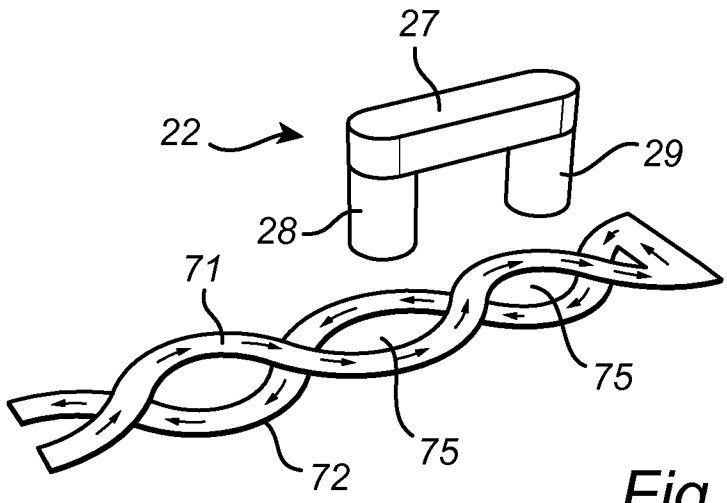

Fig. 8

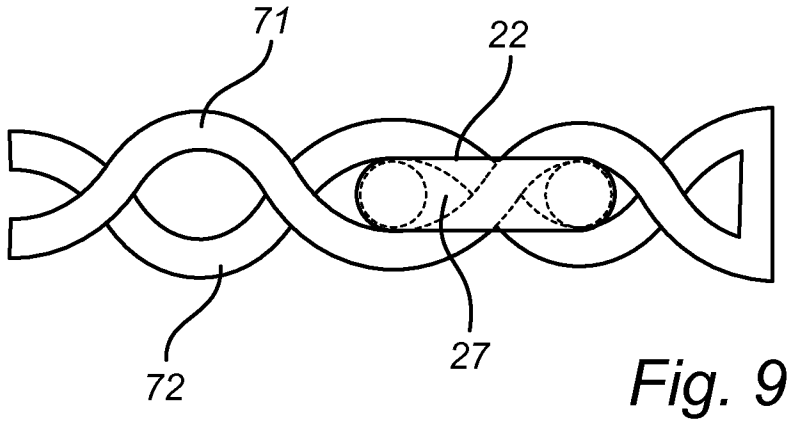

Fig. 9

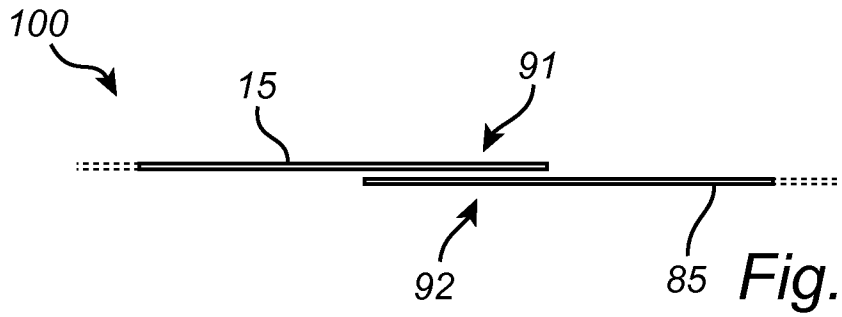

Fig. 10

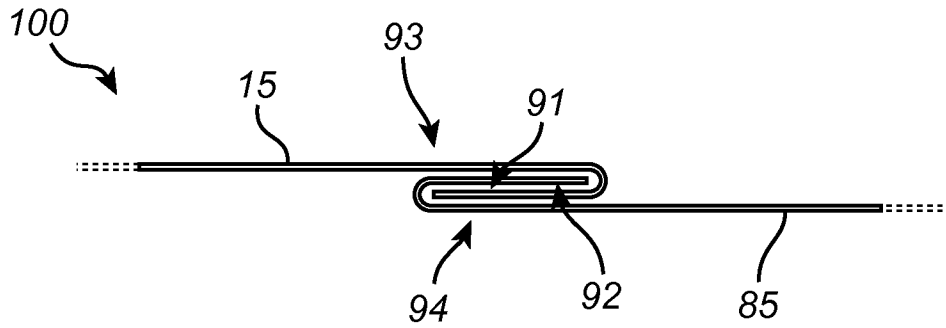

Fig. 11

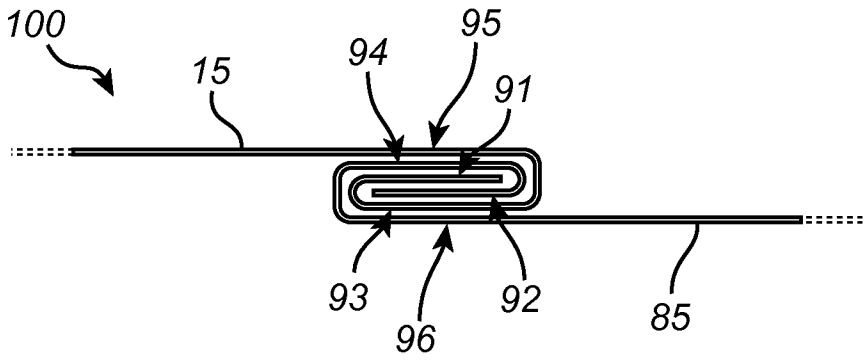

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/067626

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05B33/08 H02J50/10 H02J50/05
ADD.

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)
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

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Y	DE 10 2008 024779 A1 (OSRAM GMBH [DE]) 26 November 2009 (2009-11-26) paragraphs [0090], [0083], [0052], [0053], [0055]; figure 1	1-11
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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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 September 2018	26/09/2018

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	Müller, Uta

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 2014/060921 A1 (KONINKL PHILIPS NV [NL]) 24 April 2014 (2014-04-24) figure 1	1-11
Y	US 2014/103486 A1 (LI XIULING [US] ET AL) 17 April 2014 (2014-04-17) figures 2A,2B	1-11
Y	US 2009/302690 A1 (KUBONO FUMIO [JP] ET AL) 10 December 2009 (2009-12-10) figures 1-27	1-11
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Y	WO 2017/055115 A1 (PHILIPS LIGHTING HOLDING BV [NL]) 6 April 2017 (2017-04-06) figure 3	1
Y	US 2014/049972 A1 (MCGUIRE KENNETH STEPHEN [US] ET AL) 20 February 2014 (2014-02-20) paragraphs [0145], [0151], [0220]; figure 72A	1-11

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Information on patent family members

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