(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 269 865 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.11.2023 Bulletin 2023/44

(21) Application number: **22175280.1**

(22) Date of filing: **25.05.2022**

(51) International Patent Classification (IPC):
F21S 6/00 *(2006.01)* ***F21V 17/00*** *(2006.01)*
F21V 21/116 *(2006.01)* ***F21V 23/00*** *(2015.01)*
F21V 23/04 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F21V 17/002; F21S 6/006; F21V 23/008;
F21V 21/116; F21V 23/002; F21V 23/0442

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **29.04.2022 EP 22170755**

(71) Applicant: **Thorn Lighting Limited**
Spennymoor, Durham DL16 6HL (GB)

(72) Inventors:
- **KELLY, Thomas**
  6850 Dornbirn (AT)
- **PILKINGTON, Gary**
  6850 Dornbirn (AT)
- **MAUGHAN, Steve**
  6850 Dornbirn (AT)
- **COOK, David**
  6850 Dornbirn (AT)
- **STOCKLEY, Paul**
  6850 Dornbirn (AT)
- **WILKINSON, Christopher**
  6850 Dornbirn (AT)
- **GRÜNDEL, Harald**
  6850 Dornbirn (AT)
- **BERGMANN, Martin**
  6850 Dornbirn (AT)
- **BOHMANN, Gernot**
  6850 Dornbirn (AT)
- **HAWKE, Dixon**
  6850 Dornbirn (AT)

(74) Representative: **Kiwit, Benedikt**
Mitscherlich PartmbB
Patent- und Rechtsanwälte
Karlstraße 7
80333 München (DE)

(54) MODULAR FREE-STANDING LUMINAIRE

(57) The present invention refers to a modular free-standing luminaire (1), comprising a base (2) for placing the luminaire (1) on a floor, a pole (3) being releasably mounted to the base (2) and extending upwards from the base (2) to an upper end (30) of the pole (3) being distant from the base (2), a connector (8) having a connector body (80) being releasably mounted to the pole (3) so as to extend horizontally from the pole (3) along an extension axis (E), the connector body (80) having a mounting surface (86) extending parallel to the extension axis (E) and facing horizontally outwards, at least one luminaire head (4) having a head body (40) being releasably mounted to the mounting surface (86) so as to extend axially and horizontally away from the connector (8) along a protruding direction (D), and at least one light source (5) being housed in a light space (41) defined by the head body (40) so as to emit light through a light emission opening (42) of the luminaire head (4). The invention further refers to a kit for assembling the modular free-standing luminaire (1).

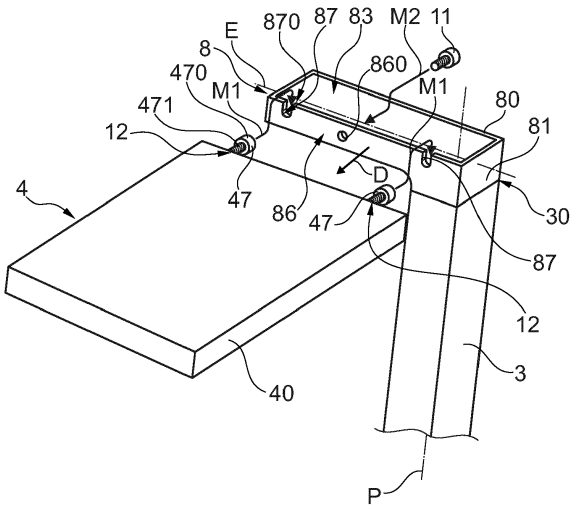

Fig. 27

EP 4 269 865 A1

Description

[0001] The present invention relates to a modular free-standing luminaire and a kit for assembling such a luminaire.

[0002] Free-standing luminaires are well known in the prior art. Usually, free-standing luminaires are large in size, and efficient shipping often requires that a customer must assemble the luminaire from modular parts and make electrical connections at the location of operation. Due to the size and weight of such luminaires, this often requires more than one person.

[0003] Also, customers ask for an overall slim appearance of the luminaire - e.g. the stand, the pole and the luminaire head - which requires the use of slim drive products. Slim drive products with multiple electrical connections require careful wire management features to avoid wire traps and thus customer dissatisfaction.

[0004] There is also a tendency for the luminaire head of free-standing luminaires to sag under its own weight so that it sits below horizontal - i.e. is angled with respect to horizontal - thus resulting in a decreased aesthetic appearance and lighting characteristic.

[0005] If the lighting requirements change where known free-standing luminaires are applied, a head change or even a complete luminaire change is necessary, e.g. when going from lighting one desk to lighting two desks. Often, multiple head luminaires are fitted with heads of the same basic form, which limits the flexibility of task lighting. For instance, a customer may need a different distribution of light on an adjacent desk.

[0006] Moreover, environmental concerns are driving a requirement for products in general - and thus also luminaires in particular - to be more easily updated, upgraded, maintained and repaired.

[0007] It is thus an object of the present invention to provide a modular free-standing luminaire which can be assembled and reassembled easily and accurately, and preferably having a high maintenance ability and allowing a high variety of products preferably with a limited number of components.

[0008] These and other objects, which become apparent upon reading the description, are solved by the subject-matter of the independent claim. The dependent claims refer to preferred embodiments of the invention.

[0009] According to a first aspect, the present invention is directed to a modular free-standing luminaire (in the following also referred to as "luminaire"). The luminaire comprises a base for placing the luminaire on a floor. The luminaire further comprises a pole being releasably mounted to the base and extending upwards, preferably substantially upwards, from the base to an upper end of the pole being - at least vertically - distant from the base. Within the scope of the present invention, "extending upwards" means that the pole extends with its upper end to a position being raised compared to the base irrespective of the extension direction of the pole. The luminaire further comprises a connector having a connector body being releasably mounted to the pole so as to extend (substantially) horizontally from the pole along an extension axis. The connector body comprises a mounting surface extending parallel to the extension axis and facing horizontally (i.e. laterally) outwards. The luminaire further comprises at least one luminaire head having a head body being releasably mounted to the mounting surface so as to extend axially (i.e. with respect to the extension axis) and (substantially) horizontally away from the connector (i.e. from the mounting surface) along a protruding direction. The luminaire further comprises at least one light source being housed in a light space defined by the head body so as to emit light through a light emission opening of the luminaire head (for instance, as a primary light for main light output of the luminaire, e.g. as a downlight).

[0010] Within the scope of the present invention, "releasably mounted" means that the respective parts are fixedly mounted or attached to each other in a releasable or detachable manner, and are thus in the (releasably) mounted state physically connected according to the operation purpose of the free-standing luminaire.

[0011] The separate connector functions as an interface between the pole and the luminaire head thus offering ease of installation, e.g., by a single person. The defined extended mounting surface allows for an easy and accurate mounting of the luminaire head. The defined mounting surface may also allow for mounting of different luminaire heads, e.g., being different in size or weight or light distribution, thus providing a possibility to increase the luminaire's application. The defined oriented mounting surface further allows for a most accurate installation of the luminaire head, and thus a high aesthetic appearance of the luminaire as well as accurate lighting characteristic. The releasable mounting of the respective parts further allows for an easy and cost-efficient maintenance ability, and further allows for easily accommodating new technologies by future replacement of the individual elements without replacing the whole luminaire.

[0012] The connector body is preferably releasably mounted to the upper end of the pole. Hence, the luminaire head can be provided at an uppermost position of the luminaire thus allowing for good illumination and easy assembly.

[0013] The connector body can preferably extend longitudinally along the extension axis. Hence, a simple layout of the connector body can be obtained, thus facilitating the production of the connector as well as assembly of the luminaire head.

[0014] The connector body can preferably extend horizontally from the pole, preferably from its upper end, at one side of the pole. Hence, an asymmetric layout of the luminaire can be obtained to allow for a defined lighting with respect to the pole; i.e. laterally offset with respect to the pole. The connector body may also extend horizontally from the pole at two opposite sides of the pole. Hence, the connector body can be provided with respect to the pole at two sides as desired. Of course, in the same

manner as the connector body extends from the pole, also the mounting surface extends at the one side or at the two opposite sides of the pole.

[0015] The connector may comprise a connection section for releasably mounting the connector to the pole. This can facilitate a defined mounting of the connector to the pole, thus reducing a risk of false assembly.

[0016] The connection section may preferably be provided at a centre of the connector, more preferred of the connector body, along the extension axis. This allows for a well balanced weigh distribution while allowing for a symmetric layout of the luminaire. The connection section may also be provided at an axial end of the connector, more preferred of the connector body, with respect to the extension axis. This allows for an asymmetric assembly of the luminaire head. In the latter case, the connector functions as a cantilever to allow for a defined positioning - i.e. mounting - of the luminaire head, as desired; even for luminaires being smaller in dimension.

[0017] The connector body may comprise a component space for receiving electrical and/or electronic components for operating the luminaire, i.e. the light source. Hence, at least part of the electrical and/or electronic components can be provided in the connector and thus do not need to be provided in the luminaire head. This may facilitate the wiring of the luminaire as well as its maintenance ability. In addition, the luminaire head can be reduced in weight thus facilitating the assembly. As the luminaire head extends along the protruding direction, reduction in weight also reduces leverage, which may further allow for simplified mounting features (e.g. reduced in number, dimension), which further results in an overall reduction in weight of the luminaire. Moreover, the production of the luminaire head can be facilitated due to it being less complex, thus also reducing the production costs.

[0018] The electrical and/or electronic components may comprise electrical connection terminals. Hence, wiring can be facilitated as the electrical connection ports - namely the electrical connection terminals - can be provided at an easily accessible position. In addition, the wiring of the luminaire head and its light sources can be finished at the production site, thus reducing the risk of false wiring and false assembly by the customer. The electrical and/or electronic components may also comprise light control elements so as to easily provide the luminaire with control functions, as desired, in an easy manner. This may also allow to easily upgrade the luminaire, e.g., by adding new control functions to an existing luminaire by simply providing or updating corresponding light control elements in the connector body, without replacing the luminaire head. Moreover, if general control features of the luminaire are provided in the connector, they can be easily applied to all luminaire heads being attached thereto. This may further reduce the costs for the luminaire heads.

[0019] The connector may further comprise a mounting plate carrying the electrical and/or electronic components and being releasably mounted within the component space. Hence, maintenance or replacement of different functionalities provided by the given electrical and/or electronic components can be easily obtained. Furthermore, as the electrical and/or electronic components can be pre-assembled to the mounting plate, assembly by the customer can be facilitated, false assembly can be avoided, and assembly or replacement of a desired functionality can be easily obtained.

[0020] The connector may comprise a cover being releasably mounted to the connector body for closing or sealing the component space. Hence, the components can be safely housed within the connector body, thus being protected from physical or otherwise environmental impacts. This may even allow to house the corresponding components in the connector body according to a defined IP protection class.

[0021] The connector may comprise two mounting surfaces each extending parallel to the extension axis and facing horizontally outwards and away from each other at opposite sides of the extension axis. Hence, the mounting flexibility of the modular free-standing luminaire can be increased. Dependent on the layout of the connector and its extension direction with respect to the pole, this layout allows for providing a luminaire head at one side of the extension axis, at the other side of the extension axis or at both sides of the extension axis, this at one side of the pole, at the other side of the pole, at both sides of the pole or even across the pole. Hence, a plurality of mounting possibilities can be provided, thus allowing for a most flexible system, which can be easily adapted to accommodate new lighting desires. This combined with the efficient assembly and easy disassembly allows for an overall flexible system. Due to the ability to mount luminaire heads of different sizes/dimensions, different lighting characteristics (e.g. light distributions), different numbers and different positions allows for designing the luminaire in a most flexible way, as desired; resulting in a high variety of products with limited number of components.

[0022] The luminaire may thus comprise a plurality of the luminaire heads being releasably mounted to the mounting surface or mounting surfaces. In a preferred embodiment, the plurality of luminaire heads can be mounted at the same mounting surface so as to extend axially and horizontally away from the connector at the same side of the extension axis along a protruding direction, respectively. The protruding directions are preferably parallel to each other. The luminaire heads are preferably arranged side-by-side. The luminaire heads may alternatively or additionally be mounted at the two mounting surfaces, if present, so as to extend axially and horizontally away from the connector at opposite sides of the extension axis in a protruding direction, respectively, which protruding directions are preferably directing away from each other and are more preferred coaxial with respect to each other. The luminaire heads can thus be arranged in a plurality of possible ways, constellations

and configurations, as desired, to satisfy numerous aesthetic and lighting requirements; this combined with the highly flexible functionality and easy assembly, as described.

[0023] The luminaire head maybe a panel light so as to provide a flat luminaire head preferably with a high light output and a high aesthetic appearance.

[0024] The luminaire head may substantially extend in a horizontal plane for a good aesthetic appearance, a high light output, e.g. for downlight and/or uplight, as well as an easy production and assembly.

[0025] The light emission opening may face downwards to emit downlight thus allowing for a defined light output, e.g., for illuminating a working space on a table. The light emission opening may also face upwards to emit uplight thus allowing for a defined light output, e.g., for atmospheric illumination.

[0026] The light emission opening may extend in a plane preferably extending horizontally. Hence, a high light output can be obtained, this preferably for obtaining an effective downlight or uplight.

[0027] The light emission opening may be defined by the head body of the luminaire head, preferably at lower side (e.g. for downlight) or at an upper side (e.g. for uplight) of the luminaire head. Hence, the layout of the luminaire head can be facilitated and the light output, preferably for obtaining downlight or uplight, can be effectively increased.

[0028] The luminaire head and preferably the head body may comprise a secondary light emission opening for emitting secondary light from the light source and/or a secondary light source housed in the light space. Hence, the functionality of the luminaire and its lighting characteristics can be further increased. By using the (primary) light source for also emitting the secondary light, the number of parts and size of the luminaire head can be reduced, and heat management be improved. By using secondary light sources, the light output for the secondary light can be optimized according to the needs, as desired.

[0029] The secondary light emission opening may preferably be provided at a side of the luminaire head being opposite to the light emission opening, preferably at an upper side (or a lower side) of the luminaire head. Hence, the secondary light can be used for illuminating an area different from the primary light, e.g. for the purpose of providing background lighting or atmospheric lighting.

[0030] The luminaire head may comprise a light emission element closing the light emission opening so as to allow light passing through for defined light output of the luminaire. Hence, the light output can be controlled, as desired.

[0031] The light emission element may extend in a horizontal plane which allows for the luminaire head having a most compact height.

[0032] The light emission element may comprise a light guide (panel) having a light input section for coupling in light of the light source, and a light output section, preferably facing outwards (e.g. preferably downwards or upwards), for emitting the coupled-in light for light output of the luminaire. By using a light guide, the luminaire head can be designed in a most compact manner, while allowing for a light output area being most flexible in size, design and lighting efficiency.

[0033] The light input section can be provided at a circumferential edge section of the light guide so as to most effectively coupling in the light of the light sources. The number and size of the light sources can thus be reduced, while keeping an efficient illumination ability, which results in the luminaire head be highly compact.

[0034] The light emission element may comprise a diffuser or diffuser plate to allow for a homogeneous light emission, as desired.

[0035] The light emission element may comprise a light directing means, like lenses or lens sections or reflectors or combinations thereof, for directing the light in a defined manner and at defined positions, to obtain for a light output characteristic, as desired.

[0036] The luminaire head may further comprise a secondary light emission element closing the secondary light emission opening so as to allow light passing through for defined secondary light output of the luminaire. Hence, the secondary light output can be controlled, as desired. The secondary light emission element may also extend in a horizontal plane for a most compact height of the luminaire head. A secondary light emission element may comprise secondary light directing means, more preferred lenses or lens sections or reflectors or combinations thereof, to allow for a light output characteristic, as desired. The secondary light emission element may also comprise a diffuser or diffuser plate for a homogeneous light emission.

[0037] The luminaire head may comprise a component compartment for receiving electrical and/or electronic operation components, like an LED driver. Hence, these components can be securely stored in the component compartment to avoid an unintended physical impact or accidental contact by a user of the respective components.

[0038] The component compartment maybe provided at the side of the luminaire head being opposite to the light emission opening, preferably at an upper side of the luminaire head. Hence, the component compartment does not interfere with a primary light emission of the luminaire while allowing for a good accessibility for maintenance.

[0039] The light source may comprise an LED module. Likewise, the secondary light source, if present, may also comprise an LED module. Hence, a most compact layout of the luminaire head can be obtained. In addition, LED technology allows for an efficient and effective illumination with a long life time. The light source and the secondary light source may share the same LED module.

[0040] The light source may be in (preferably direct) thermal contact with the head body and/or a heat sink.

Likewise, also the secondary light source, if present, may be in (preferably direct) thermal contact with the head body and/or a heat sink. The heat sink is preferably provided within the light space, and may also be in (preferably direct) thermal contact with the head body to allow for a good heat dissipation of the (secondary) light source being attached thereto. The light source and the secondary light source may share the same heat sink.

[0041] The luminaire may comprise a plurality of the light sources, if desired and according to the customer's needs. Likewise, the luminaire may comprise a plurality of the secondary light sources, if desired and according to the customer's needs.

[0042] The connector body and the head body may comprise cooperating supporting structures for releasably hanging the luminaire head at the mounting surface. Hence, the head body can be easily hung at the mounting surface thus facilitating the assembly even when being done with only one person.

[0043] The cooperating supporting structures may comprise a screw, preferably provided in the head body, and a slot, preferably provided in the connector body, for receiving the screw to support the luminaire head. Hence, the cooperating supporting structures can be provided by simple elements, thus allowing for low production costs and easy assembly. The slot can be open at its top so as to allow the screw be inserted or received from above to thus securely support the screw in the slot.

[0044] The luminaire may further comprise adjustment means for adjusting the protruding direction with respect to the connector in a vertical and/or in a horizontal direction. Hence, the luminaire head can be easily adjusted to allow for a high aesthetic appearance and defined light output; e.g. a defined downlight and/or uplight. This allows for the luminaire head or its head body to be mounted in a defined orientation in space at high accuracy to effectively fulfil the requested lighting characteristics.

[0045] The adjustment means may be configured to adjust an angle between the protruding direction and a horizontal plane comprising the extension axis. Alternatively or additionally, the adjustment means may be configured to adjust an angel between the protruding direction and a vertical plane extending orthogonal to the extension axis. The adjustment means thus give the user the ability to make fine adjustments for obtaining a most accurate aesthetical appearance and light output. Adjustment can be easily done with only one person. Also, adjustment in different spatial direction can be obtained, thus allowing for a most accurate adjustment. This maybe required, for instance, to compensate production tolerances or even topographic conditions at the site of operation, e.g. in cases where the free-standing luminaire is placed with its base on an uneven or sloping ground.

[0046] The adjustment means may be provided by an adjustment screw, which allows for using simple parts thus reducing the production costs. The screw may be the screw of the cooperating supporting structures, which even further reduces the number of parts and further facilitates the assembly even when being done with only one person.

[0047] Of course, the number of the adjustment means can be chosen as desired to allow for a more or less fine adjustment. For instance, two adjustment means, like two adjustment screws, can be provided at two distant positions being offset along or parallel to the extension axis.

[0048] The luminaire may further comprise a retaining element for releasably mounting the luminaire head to the connector at least by form fit connection. Hence, the luminaire head can be easy assembled even by one person. For instance, the retaining element can allow for the luminaire head being securely supported by the connector even during an adjustment of the luminaire head by means of the adjustment means.

[0049] Preferably, the retaining element can be a screw, which is preferably passing through the mounting surface, more preferred from the component space if present, and being screwed into the head body. Hence, the retaining element is provided by simple parts thus reducing the production costs and facilitating assembly.

[0050] The base may extend in horizontal plane thus allowing for a stable stand and a large supporting area, as desired.

[0051] The base may comprise a U-shape or an H-shape in top view. Hence, the base can be produced with minimal use of material, while obtaining a high aesthetical appearance without affecting a stable stand of the free-standing luminaire.

[0052] The base may comprise at least one or a plurality of foot elements. The foot elements may preferably be adjustable so as to level the base according to the floor at the installation location. The foot element can be a screw having a threaded shaft being screwed into a threaded hole in the base. The base may be vertically moved upon screwing motion of the foot element. The foot element thus protrudes from a bottom side of the base and maybe configured to compensate an uneven or sloped ground at the installation location upon adjustment of its protruding distance, e.g., by means of the screwing motion.

[0053] The base may comprise a mounting section for releasably mounting the pole. The mounting section can be a defined receiving section or even simply a through hole for passing through a screw or the like to releasably connect the base with the pole. Hence, a defined mounting position can be provided so as to allow for a most stable stand of the luminaire, while assembly can be facilitated. Alternatively, the releasable mounting between the pole and the base may also be provided by clamping means or the like, which may allow for a more flexible mounting position.

[0054] The mounting section maybe provided on a symmetry axis of the base for a high aesthetical appearance and an even distribution of weight. The mounting section may also be provided offset from the said symmetry axis so as to consider an uneven weigh distribution, e.g. in case the luminaire head is mounted asymmetri-

cally with respect to the pole.

[0055] The pole may extend along a pole extension axis, which pole extension axis can be straight or not straight, e.g. having an angled extension, a wavy or zigzag extension or the like. The pole can thus be designed according to the desired aesthetical and mechanical needs.

[0056] The base may be made of aluminium or steel, preferably from a steel sheet. The pole can be made of aluminium, preferably extruded aluminium. The connector body can be made of aluminium or steel, preferably cast aluminium or a bend steel sheet. The head body can be made of aluminium, preferably cast aluminium, or fabricated steel, preferably fabricated sheet metalwork. The respective elements can thus be provided by materials and manufacturing methods, which allow for an easy and cost-efficient production with optimised material characteristics.

[0057] According to another aspect, the present invention is directed to a kit for assembling a modular free-standing luminaire as defined herein above. The kit comprises the base and optionally a plurality of the bases preferably having different dimensions and/or different mounting sections and/or mounting section positions. The kit further comprises the pole and optionally a plurality of the poles preferably having different dimensions or lengths. The kit further comprises a plurality of the connectors preferably having different dimensions and/or different numbers of mounting surfaces and/or different lengths along the extension axis and/or different positions of the connection section, if present. The kit further comprises a plurality of the luminaire heads preferably having different dimensions and/or being equipped with different lighting features, like light emission elements or, if present, secondary light emission elements. The kit may optionally further comprise the electrical and/or electronic components preferably with a mounting plate, if present, suitable for the respective connector. The kit may optionally comprise one or a plurality of the covers, if present, suitable for the respective connector.

[0058] This kit allows for assembling numerous types of modular free-standing luminaires in a most flexible and easy way, as desired, with the advantages as described herein above. Hence, luminaires with different characteristics like size, dimension, design, light output, light distribution, and the like can be easily provided, assembled, upgraded, serviced, altered, etc.

[0059] Further, detailed features and advantages of the present invention will be described by the drawings of the enclosed figures.

Fig. 1 shows a perspective view of a luminaire according to a first embodiment of the present invention.

Fig. 2 shows a perspective bottom view of a luminaire head and connector of a luminaire according to a second embodiment of the present invention,

Fig. 3 shows a perspective top view of the components according to Fig. 2,

Fig. 4 shows a side view of the components according to Fig. 2,

Fig. 5 shows a perspective bottom view of a luminaire head and connector of a luminaire according to a third embodiment of the present invention,

Fig. 6 shows a perspective top view of the components according to Fig. 5,

Fig. 7 shows a cross sectional front view of the luminaire head according to Fig. 5,

Fig. 8 shows a perspective view of detail VIII of Fig. 7,

Fig. 9 shows a perspective view of the detail of Fig. 8 in an exploded view,

Fig. 10 shows a perspective view of a connector of a luminaire according to a fourth embodiment of the present invention,

Fig. 11 shows a perspective view of a connector of a luminaire according to a fifth embodiment of the present invention,

Fig. 12 shows a perspective top view of a part of a luminaire according to a sixth embodiment of the present invention,

Fig. 13 shows a side view of a pole of a luminaire according to a seventh embodiment of the present invention including electric wiring,

Fig. 14 shows a cross sectional view of the pole according to Fig. 13 viewed along the pole extension axis,

Fig. 15 shows a detail of a connector-side of the electric wiring of Fig. 13 with an electric connector,

Fig. 16 shows a top view of a connector of a luminaire according to an eighth embodiment of the present invention with the electric connector according to Fig. 15,

Fig. 17 shows a detail of a base-side of the electric wiring of Fig. 13 with another electric connector (mains socket),

Fig. 18 shows a perspective view of the other electric connector of Fig. 17,

Fig. 19 shows a bottom view of the base of the luminaire according to Fig. 1,

Fig. 20 shows a perspective view of detail XX of the luminaire according to Fig. 19,

Fig. 21 shows a perspective view of a foot element of the base according to Fig. 20,

Fig. 22 shows different configurations of the modular free-standing luminaire according to further embodiments of the present invention in a top view,

Fig. 23 shows an enlarged top view of the luminaire as shown in Fig. 22E,

Fig. 24 shows a top view of the base of the luminaire according to Fig. 23 as well as an extension for the stand,

Fig. 25 shows a top view of the base and its extension of Fig. 24 in a connected state,

Fig. 26 shows an enlarged top view of the luminaire according to Fig. 22H having the base according to Fig. 25, and

Fig. 27 shows a perspective top view of an upper part of a luminaire according to a ninth embodiment of the present invention.

[0060] The figures show different embodiments of a modular free-standing luminaire 1 according to the present invention as well as components thereof.

[0061] As can be seen in Figs. 1 and 19-27, the luminaire 1 comprises a base 2 for placing the luminaire 1 on a floor. The base 2 can be made of aluminium or steel, preferably from a steel sheet. As can be seen in Fig. 1, the base 2 may extend in a horizontal plane. The base 2 may optionally comprise at least one or a plurality of foot elements 21 (here four), which may preferably be adjustable so as to level the base 2 according to the floor at the installation location. As is shown in Figs. 20 and 21, the foot element 21 can be a screw having a threaded shaft 22 being screwed into a threaded hole in the base 2, and optionally a base screw head 23 - intended to be placed on the ground when upright standing the free-standing luminaire 1 at the installation location to support the same thereon - which can be vertically moved upon screwing motion of the foot element 21. The screwing motion can be applied via a slot at an axial end of the threaded shaft 22 to enable the foot element 21 to be adjusted from above (or below) the base 2, e.g., by using a flat bladed screwdriver. If comprising a screw head 23, it may comprise a knurled circumferential surface, which maybe used as an alternative or secondary adjustment method to support applying the screwing motion.

[0062] As can be seen in Figs. 1, 19, 23, 24 and 22A-C,E-F, the base 2 may comprise a U-shape in top view. As can be seen in Figs. 22D,G-I as well as Figs. 25 and 26, the base may also comprise an H-shape in top view. As can be seen in Figs. 24 and 25, the base 2 maybe assembled of different components connected to obtain the H-shaped version of the base 2. For instance, as shown in Fig. 24, an extension 2' maybe provided which can be selectively attached to the U-shaped base 2 so as to form the H-shaped base 2 as shown in Fig. 25.

[0063] The luminaire 1 further comprises a pole 3, as exemplarily shown in Figs. 1, 13, 19 and 27. The pole 3 is releasably mounted to the base 2 and extends upwards - here substantially vertically upwards - from the base 2 to an upper end 30 of the pole 3 being distant from the base 2, as can be clearly seen in Fig. 1.

[0064] The base 2 may comprise a mounting section 20 for releasably mounting the pole 3. The mounting section 20 can be simply provided as a through hole for allowing a screw passing through the through hole from a bottom of the base 2 so as to releasably mount or fix the pole 3 to the base 2, as exemplarily shown in Fig. 19. As can be derived from Figs. 22E-I, the mounting section 20 maybe provided on a symmetry axis S of the base 2. Alternatively, as can be derived from Figs. 22A-D, the mounting section 20 may also be provided offset from the said symmetry axis S.

[0065] The pole 3 may extend along a pole extension axis P, which here extends straight (see Figs. 1 and 13). Alternatively, the pole extension axis P may also extend not straight, like in a wavy or zigzag or angled or other extension direction.

[0066] The pole can be made of aluminium, preferably extruded aluminium, as exemplarily shown in Fig. 14. As shown, the pole 3 can have a hollow tube body 31. The pole 3 may further comprise structural elements 32; here extending along the whole length of the tube 3 and inside its hollow tube body 31. The structural elements 32 can be provided for increased rigidity of the pole 3 or even for guiding or receiving electric wiring 15 of the luminaire 1 inside the pole 3, as can be derived from Fig. 13.

[0067] The electric wiring 15 may comprise a mains socket 150 (see Figs. 13, 17, 18) being provided at a lower end 33 of the pole 3 and here being exposed through an opening in the pole 3 so as to allow a mains plug being electrically connected to the luminaire 1.

[0068] The luminaire 1 further comprises at least one luminaire head 4 having a head body 40. The head body 40 can be made of aluminium, preferably of cast aluminium, or fabricated steel, preferably fabricated sheet metalwork. The luminaire head 4 can be a panel light, as exemplarily shown in Figs. 1-9 and 27. The luminaire head 4 may substantially extend in a horizontal plane.

[0069] The luminaire 1 further comprises at least one light source 5 being housed in a light space 41 defined by the head body 40 so as to emit light through a light emission opening 42 of the luminaire head 4.

[0070] The light emission opening 42 can preferably be defined by the head body 40 of the luminaire head 4, preferably at a lower side of the luminaire head 4, as exemplarily shown in Figs. 1-9. The light emission opening 42 can face downwards to emit downlight, as exemplarily shown in Fig. 1. The light emission opening 42 may extend in a plane and may preferably extend horizontally, as can be derived from Figs. 2 and 4.

[0071] With reference to Figs. 7-9, the luminaire head 4 will now be described in more detail.

[0072] The luminaire head 4 may comprise a light emission element 43 closing the light emission opening 42 so as to allow light passing through for defined light output of the luminaire 1. The light emission element 43 may extend in a horizontal plane, as clearly derivable from Fig. 7.

[0073] As clearly seen in Figs. 8 and 9, the light emission element 43 may comprise a light guide 430 having a light input section 431 for coupling in light of the light source 5. The light input section 431 here is provided at a circumferential edge section of the light guide 430 for an effective light input. The light guide 430 may further comprise a light output section 432 preferably facing outwards - here downwards - for emitting the coupled-in light

for a defined light output - here downlight - of the luminaire 1.

[0074] The light emission element 43 may further comprise a diffuser or diffuser plate 433, which is here provided downstream with respect to the light output section 432; i.e. below the light guide 430. The light emission element 43 may alternatively or additional comprise further optical elements, like an optic foil, e.g., positioned between the diffuser 433 and the light guide (panel) 430.

[0075] The light emission element 43 may further comprise a light directing means, like lenses, lens sections and/or reflectors 434; here provided at a rear side of the light guide as a reflector plate for an increased light efficiency.

[0076] The light source 5 may comprise an LED module 50 with LEDs 51 on a PCB 52, as exemplarily shown in Figs. 8 and 9. The light source 5 can preferably be in thermal contact with the head body 40 for improved heat dissipation, particularly when using an LED module 50 as the light source 5. For an improved light emission or desired light emission characteristics, the luminaire 1 may comprise a plurality of the light sources 5, which may be controlled together, in groups or individually, as desired.

[0077] As can be seen in Fig. 8, a spacer 16 can be provided edge-wise with respect to the light emission element 43 to allow for a defined relative positioning of the light emission element 43 and its components; this preferably also in relation to the light source 5.

[0078] As can be also seen from Figs. 7-9, the luminaire head 4 and preferably its head body 40 may comprise a secondary light emission opening 44 for emitting secondary light (e.g. back light or atmospheric light or the like) from the light source 5 or, as shown in the present embodiment, a secondary light source 6 housed in the light space 41.

[0079] The secondary light emission opening 44 is preferably provided at a side of the luminaire head 4 being opposite to the light emission opening 42, more preferred and as shown in Figs. 6 and 7-9 at an upper side of the luminaire head 4.

[0080] The luminaire head 4 may also comprise a secondary light emission element 45 closing the secondary light emission opening 44 so as to allow light passing through for defined secondary light output of the luminaire 1. As shown in Fig. 9, the secondary light emission element 45 may extend in a horizontal plane. Also, the secondary light emission element 45 may comprise secondary light directing means like lenses or, as shown in the embodiment of Figs. 8 and 9, reflectors 454.

[0081] The secondary light emission element 45 may also comprise a diffuser 453 or diffuser plate; here in the form of a cover, as shown in Figs. 6-9.

[0082] The secondary light source 6 may comprise an LED module 60 with LEDs 61 on a PCB 62. For an improved light emission or desired light emission characteristics, the luminaire 1 may comprise a plurality of the secondary light sources 6, which may be controlled together, in groups or individually, as desired. A high reflective mask 17 may be provided to surround the respective LEDs 51 on the PCB 52 so as to increase light efficiency.

[0083] The secondary light source 6 can be in thermal contact with a heat sink 7, here also provided inside the light space 41. The heat sink 7 can be thermally connected to the head body 40. The secondary light source 6 can also be in direct thermal contact with the head body 40.

[0084] The luminaire 1 further comprises a connector 8 having a connector body 80 being releasably mounted to the pole 2, preferably to the upper end 30 of the pole 3, so as to extend horizontally from the pole 3 (or its upper end 30) along an extension axis E, as exemplarily shown in Figs. 2, 3, 5, 6, 10-12, 22A,C, 23, 26 and 27. The connector body 80 preferably extends longitudinally along the said extension axis E.

[0085] As exemplarily shown in Figs. 22A-D, the connector body 80 extends horizontally from the pole 3, preferably its upper end 30, at one side of the pole 3. Alternatively, as exemplarily shown in Figs. 22E-I, the connector body 80 may also extend horizontally from the pole 3, preferably its upper end 30, at two opposite sides of the pole 3.

[0086] The connector 8 may comprise a connection section 81 for releasably mounting the connector 8 to the pole 3. Here, the connection section 81 is provided in the form of a structural hollow receiving element preferably designed to fit onto the upper end 30 of the pole 3. The connector 8 may thus easily be put onto the upper end 30 of the pole 3 from above. The connector 8 may further be fixed to the pole 3 by a screw being screwed, e.g., from the side or above through the connection section 81 into the upper end 30 of the pole 3.

[0087] As is exemplarily shown in Fig. 11 (see also Figs. 22E-I), the connection section 81 can preferably be provided at a centre of the connector 5 along the extension axis E. As exemplarily shown in Figs. 10 and 27 (see also Figs. 22A-D), the connection section 81 can alternatively be provided at an axial end 82 of the connector 8 and more preferred of the connector body 80.

[0088] As can be seen in Figs. 10-12, 16 and 27, the connector body 80 may comprise a component space 83 for receiving electrical and/or electronic components 9 for operating the light source 5 and, if present, also the secondary light source 6. The electrical and/or electronic components 9 may comprise electrical connection terminals 90 and/or light control elements. The electric wiring 15 may comprise an electric connector 151 (see Figs. 13, 15, 16) being provided at the upper end 30 of the pole 3 and here protruding out of the upper end 30 of the pole (see Fig. 13) so as to be connected to the electrical and/or electronic components 9 in the connecter 8 for electrical distribution, e.g. to the luminaire head 4, of the current received via the mains socket 150 to operate the luminaire 1.

[0089] The connector 8 may comprise a mounting plate

84 carrying the electrical and/or the electronic components 9 and being releasably mounted within the component space 83, as exemplarily shown in Figs. 16.

[0090] As exemplarily shown in Figs. 3 and 6, the connector 8 may comprise a cover 85 being releasably mounted to the connector body 80 for closing or sealing the component space 83.

[0091] The luminaire head 4 may comprise a component compartment 46 for receiving electrical and/or electronic operation components, like an LED driver 10 (see Fig. 12). The component compartment 46 is preferably provided at a side of the luminaire head 4 being opposite to the light emission opening 42, here preferably at an upper side of the luminaire head 4, as is exemplarily shown in Figs. 3 and 6. The component compartment 46 is here at least partially surrounded or flanked by the secondary light emission opening 44 or secondary light emission element 45, as is exemplarily shown in the embodiment of Fig. 6.

[0092] The luminaire 1, preferably the luminaire head 4 and/or the connector 8, may be provided with sensors 13, 14. The sensors 13, 14 can be provided at any desired location in or at the luminaire 1. For instance, the sensor 13 can be provided at an upper side of the luminaire 1, preferably at an upper side of the connector 8, e.g. its cover 85, or at an upper side of the luminaire head 4, e.g. a cover of the component compartment 46 as shown in Figs. 3 and 6. Such a sensor 13 can be, for instance, a swarm sensor or another type of wired or wireless control sensor. The sensor 14 may also be provided at a side of the luminaire 1 being able for inspecting an illumination area of the luminaire 1 and/or the surrounding of the luminaire 1. As exemplarily shown in Figs. 2 and 5, the sensor 14 may preferably be provided at a lower side of the luminaire head 4. Such a sensor may be a presence or daylight sensor or any other type of inspection sensor for controlling the luminaire 1.

[0093] With particular reference to Figs. 12 and 27, the connector body 80 comprises a mounting surface 86 extending parallel to the extension axis E and facing horizontally - i.e. laterally - outwards. The mounting surface 86 is thus preferably vertically oriented to spatially extend in a vertical plane and facing laterally outwards with respect to the connector 8 or connector body 80; i.e. away from the extension axis E. In the shown embodiments, the connector 8 comprises two mounting surfaces 86 each extending parallel to the extension axis E and facing horizontally outwards and away from each other at opposite (lateral) sides of the extension axis E or connector 8.

[0094] The at least one luminaire head 4 is releasable mounted to the mounting surface 86 so as to extend axially (i.e. with respect to the extension axis E) and substantially horizontally away from the connector 8 along a protruding direction D (see Figs. 1-6, 12, 22A,C,D,G, 23, 26 and 27). Optionally, a spacer plate 18 (see Fig. 12) may be provided between the connector 8 - i.e. the mounting surface 86 - and the luminaire head 4, to be sandwiched therebetween in the mounted state.

[0095] As can be seen in Fig. 22D,F-I, the luminaire 1 may comprise a plurality of the luminaire heads 4 being releasably mounted to the mounting surface or mounting surfaces 86. The luminaire heads 4 can be releasably mounted at the same mounting surface 86 so as to extend axially and horizontally away from the connector 8 at the same side of the extension axis E and may preferably be arranged side-by-side, as exemplarily shown in Fig. 22F and 22G as well as on the right-handed side of Fig. 22I. The luminaire heads 4 may also be releasably mounted at the two mounting surfaces 86 so as to extend axially and horizontally away from the connector 8 at opposite sides of the extension axis E and preferably away from each other, as exemplarily shown in Fig. 22G-I.

[0096] If there are provided two mounting surfaces 86 and only one of which is occupied by a luminaire head 4 being mounted thereto, the other unoccupied mounting surface 86 may be covered with a blanking cover (not shown) for an improved aesthetical appearance.

[0097] The connector body 80 and the head body 40 may comprise cooperating supporting structures 47, 87 for releasably hanging the luminaire head 4 at the mounting surface 86, as is exemplarily illustrated in Figs. 12 and 27. The cooperating supporting structures may comprise a screw 47 preferably provided in the head body 4, and a slot 87 preferably provided in the connector body 8 for receiving the screw 47 to support the luminaire head 4. Therefore, the screw 47 is screwed into the head body 4 (here into threaded through holes 48) so that the screw head 470 protrudes outwardly from the head body 4. The slot 87 has an upper opening 870 through which the screw 47 with its screw shaft 471 is inserted (see arrows M1 in Fig. 27) so that the screw head 470 lies opposite to the mounting surface 86 with respect to the luminaire head 4; here inside the component space 83.

[0098] The luminaire 1 may further comprise a retaining element 11 for releasably mounting the luminaire head 4 to the connector 8, preferably its mounting surface 86, at least by form fit connection. As exemplarily shown in Figs. 12 and 27, the retaining element 11 can be a screw preferably passing through the mounting surface 86 - here a through hole 860 in the mounting surface 86 - preferably from the component space 83 (see arrow M2 in Fig. 27) and being screwed into the head body 4, here into threaded through holes 49.

[0099] The luminaire head 4 may thus be first hung at the mounting surface 86 by means of the cooperating supporting structures 87, 47 (arrow M1 in Fig. 27), and is then retained by providing the retaining element 11 (arrow M2 in Fig. 27). Hence, the luminaire head 4 can be assembled by only one person in an easy and safe manner.

[0100] The luminaire 1 may further comprise adjustment means 12 (see Figs. 12 and 27) for adjusting the protruding direction D with respect to the connector 8 or its mounting surface 86 in a vertical and/or in a horizontal direction. The adjustment means 12 may be configured

to adjust an angle α between the protruding direction D and a horizontal plane H comprising the extension axis E (as exemplarily shown in Fig. 4 for virtual protruding directions D indicated by dotted lines deviating from the horizontal orientation indicated by the horizontal plane H) and/or an angle β between the protruding direction D and a vertical plane V extending orthogonal to the extension axis E (as exemplarily shown in Fig. 22C for virtual protruding directions D indicated by dotted lines deviating from the orthogonal orientation indicated by the vertical plane V).

[0101] As exemplarily shown in Figs. 12 and 27, the adjustment means 12 can be provided by an adjustment screw, which here is preferably provided by the screw 47 of the cooperating supporting structures.

[0102] After having retained or fixed the luminaire 4 to the connector 8 by the retaining element 11, adjustment means 12 can be used for selectively adjusting the orientation of the luminaire head 4. For an accurate and fine adjustment, there may be provided at least two adjustment means 12 preferably distanced along or parallel to the extension axis E.

[0103] According to a preferred embodiment of the present invention, a kit for assembling a modular free-standing luminaire 1 according to the present invention and as exemplarily described herein above with reference to Figs. 1-27 is provided. The kit comprises the base 2 and optionally a plurality of the bases 2 preferably having different dimensions and/or different mounting sections 20 and/or mounting section positions. The kit further comprises the pole 3 or optionally a plurality of the poles 3 preferably having different dimensions or lengths. The kit further comprises a plurality of the connectors 8 preferably having different dimensions and/or different numbers of mounting surfaces 86 and/or different lengths along the extension direction E and/or different positions of the connection section 81. The kit further comprises a plurality of the luminaire heads 4 preferably having different dimensions and/or being equipped with different lighting features, like light emission elements 43 or, if present, secondary light emission elements 45. The kit further comprises at least one or a plurality of the light sources 5 and preferably also of the secondary light sources 6. The kit may further optionally comprise the electrical and/or electronic components 9 preferably with a mounting plate 84 suitable for the respective connector 8. The kit may further comprise optionally one or a plurality of the covers 85 suitable for the respective connector 8.

[0104] The present invention is not limited by the embodiments as described herein above as long as being covered by the appended claims. All the features of the embodiments described herein above can be combined in any possible way and be provided interchangeably.

Claims

1. Modular free-standing luminaire (1), comprising:

   a base (2) for placing the luminaire (1) on a floor,
   a pole (3) being releasably mounted to the base (2) and extending upwards from the base (2) to an upper end (30) of the pole (3) being distant from the base (2),
   a connector (8) having a connector body (80) being releasably mounted to the pole (3) so as to extend horizontally from the pole (3) along an extension axis (E),
   the connector body (80) having a mounting surface (86) extending parallel to the extension axis (E) and facing horizontally outwards,
   at least one luminaire head (4) having a head body (40) being releasably mounted to the mounting surface (86) so as to extend axially and horizontally away from the connector (8) along a protruding direction (D), and
   at least one light source (5) being housed in a light space (41) defined by the head body (40) so as to emit light through a light emission opening (42) of the luminaire head (4).

2. Modular free-standing luminaire (1) according to claim 1,

   wherein the connector body (80) is releasably mounted to the upper end (30) of the pole (3), and/or
   wherein the connector body (80) extends longitudinally along the extension axis (E), and/or
   wherein the connector body (80) extends horizontally from the pole (3),
   preferably from its upper end (30), at one side or at two opposite sides of the pole (3).

3. Modular free-standing luminaire (1) according to any one of the preceding claims,

   wherein the connector (8) comprises a connection section (81) for releasably mounting the connector (8) to the pole (3),
   wherein the connection section (81) preferably is provided at a center of the connector (8) along the extension axis (E) or at an axial end (82) of the connector (8), more preferred of the connector body (80).

4. Modular free-standing luminaire (1) according to any one of the preceding claims,
   wherein the connector body (80) comprises a component space (83) for receiving electrical and/or electronic components (9) for operating the light source (5), wherein preferably the electrical and/or electronic components (9) comprise electrical con-

nection terminals (90) and/or light control elements.

5. Modular free-standing luminaire (1) according to claim 4,

wherein the connector (8) comprises a mounting plate (84) carrying the electrical and/or electronic components (9) and being realeasably mounted within the component space (83), and/or
wherein the connector (8) comprises a cover (85) being releasably mounted to the connector body (80) for closing or sealing the component space (83).

6. Modular free-standing luminaire (1) according to any one of the preceding claims,
wherein the connector (8) comprises two mounting surfaces (86) each extending parallel to the extension axis (E) and facing horizontally outwards and away from each other at opposite sides of the extension axis (E).

7. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the luminaire comprises a plurality of the luminaire heads (4) being releasably mounted to the mounting surface(s) (86),
preferably at the same mounting surface (86) so as to extend axially and horizontally away from the connector (8) at the same side of the extension axis (E), preferably arranged side-by-side, and/or
preferably at the two mounting surfaces (86), if present, so as to extend axially and horizontally away from the connector (8) at opposite sides of the extension axis (E), preferably away from each other.

8. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the luminaire head (4) is a panel light, and/or
wherein the luminaire head (4) substantially extends in a horizontal plane, and/or
wherein the light emission opening (42) is facing downwards to emit downlight, and/or
wherein the light emission opening (42) extends in a plane, preferably extending horizontally, and/or
wherein the light emission opening (42) is defined by the head body (40) of the luminaire head (4), preferably at a lower side of the luminaire head (4).

9. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the luminaire head (4) comprises a light emission element (43) closing the light emission opening (42) so as to allow light passing through for defined light output of the luminaire (1),
wherein preferably the light emission element (43) extends in a horizontal plane, wherein preferably the light emission element (43) comprises a light guide (430) having a light input section (431) for coupling in light of the light source (5), and a light output section (432), preferably facing outwards, for emitting the coupled in light, wherein preferably the light input section (431) is provided at a circumferential edge section of the light guide (430).

10. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the light source (5) comprises an LED module (50), and/or
wherein the light source (5) is in thermal contact with the head body (40), and/or
wherein the luminaire (1) comprises a plurality of light sources (5).

11. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the connector body (80) and the head body (40) comprising cooperating supporting structures (47, 87) for releasably hanging the luminaire head (4) at the mounting surface (86),
wherein preferably the cooperating supporting structures comprising a screw (47), preferably provided in the head body (40), and a slot (87), preferably provided in the connector body (80), for receiving the screw (47) to support the luminaire head (4).

12. Modular free-standing luminaire (1) according to any one of the preceding claims,

further comprising adjustment means (12) for adjusting the protruding direction (D) with respect to the connector (8) in a vertical and/or in a horizontal direction, wherein preferably the adjustment means is configured to adjust an angle α between the protruding direction (D) and a horizontal plane (H) comprising the extension axis (E) and/or an angle β between the protruding direction (D) and a vertical plane (V) extending orthogonal to the extension axis (E),
wherein preferably the adjustment means are provided by an adjustment screw, preferably the screw (47) of the cooperating supporting structures (47,87), if present.

13. Modular free-standing luminaire (1) according to any

one of the preceding claims,

further comprising a retaining element (11) for realeasably mounting the luminaire head (4) to the connector (8), preferably the mounting surface (86), at least by form fit connection,
wherein preferably the retaining element (11) is a screw preferably passing through the mounting surface (86), more preferred from the component space (83) if present, and being screwed into the head body (40).

14. Modular free-standing luminaire (1) according to any one of the preceding claims,

wherein the base (2) extends in a horizontal plane, and/or
wherein the base (2) comprises a U-shape or an H-shape in top view, and/or
wherein the base (2) comprises a mounting section (20) for releasably mounting the pole (3), wherein preferably the mounting section (20) is provided on a symmetry axis (S) of the base (2) or offset from the said symmetry axis (S), and/or
wherein the pole (3) extends along a pole extension axis (P), wherein the pole extension axis (P) extends straight or not straight.

15. Kit for assembling a modular free-standing luminaire (1) according to any one of the preceding claims, comprising:

the base (2), optionally a plurality of the bases (2), preferably having different dimensions and/or, if present, different mounting sections (20) and/or mounting section positions,
the pole (3), optionally a plurality of the poles (3), preferably having different dimensions or lengths,
a plurality of the connectors (8), preferably having different dimensions and/or different numbers of mounting surfaces (86) and/or different lengths along the extension axis (E) and/or different positions of the connection section (81), if present.
a plurality of the luminaire heads (4), preferably having different dimensions,
at least one or a plurality of the light sources (5), optionally the electrical and/or electronic components (9), preferably with a mounting plate (84), if present, suitable for the respective connector (8),
optionally one or a plurality of the covers (85), if present, suitable for the respective connector (8).

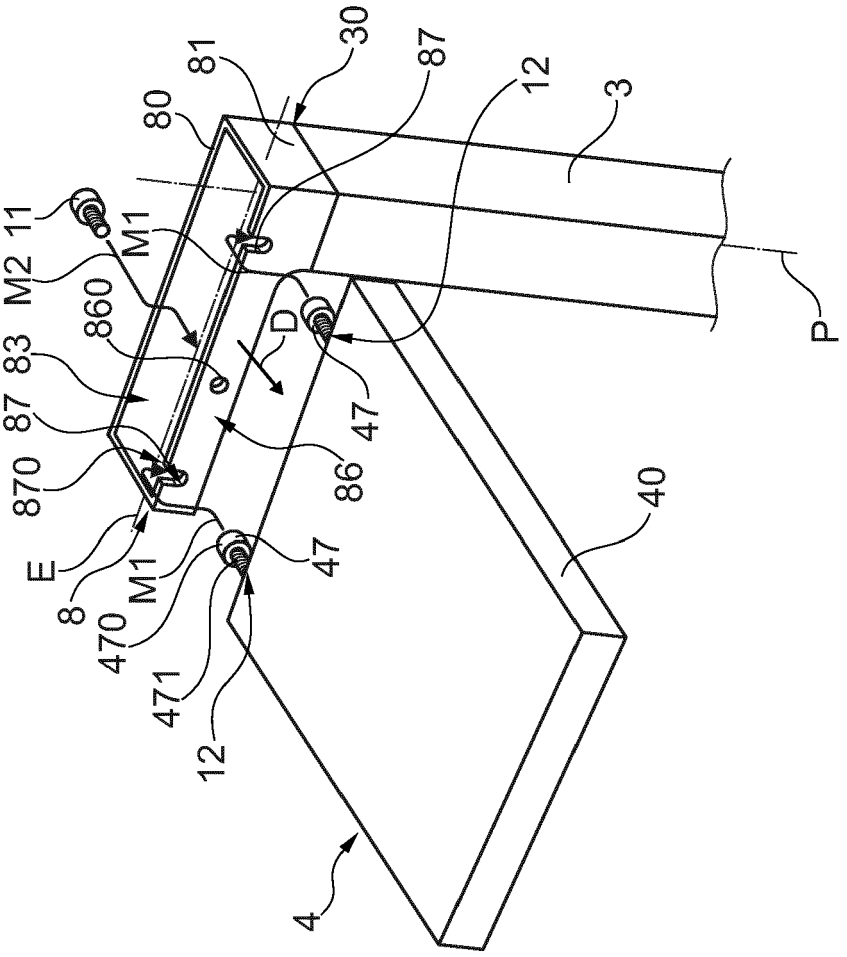
81
30
87
12
3
80
11
M1
M2
860
D
83
87
870
E
8
M1
470
471
12
47
86
47
40
4
P

Fig. 27

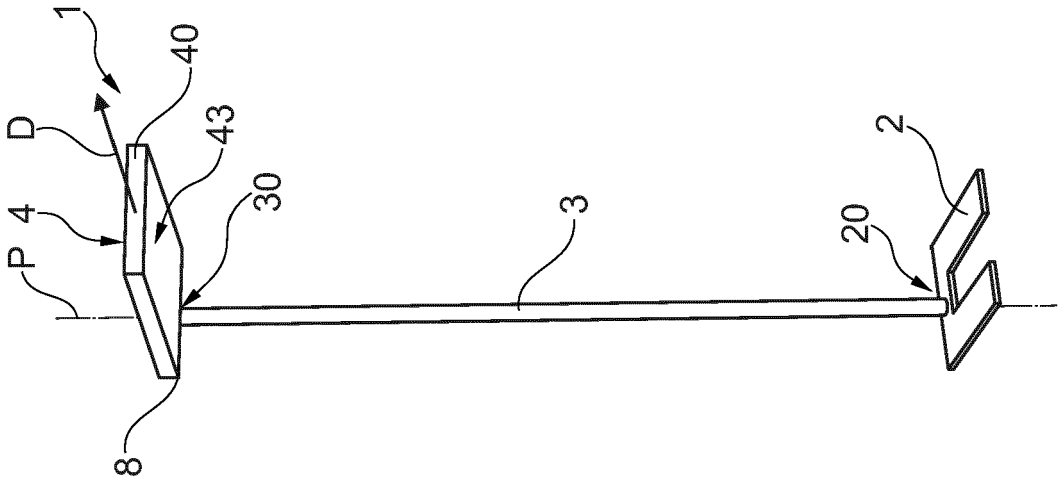
1
40
D
43
P
4
30
3
2
20
8

Fig. 1

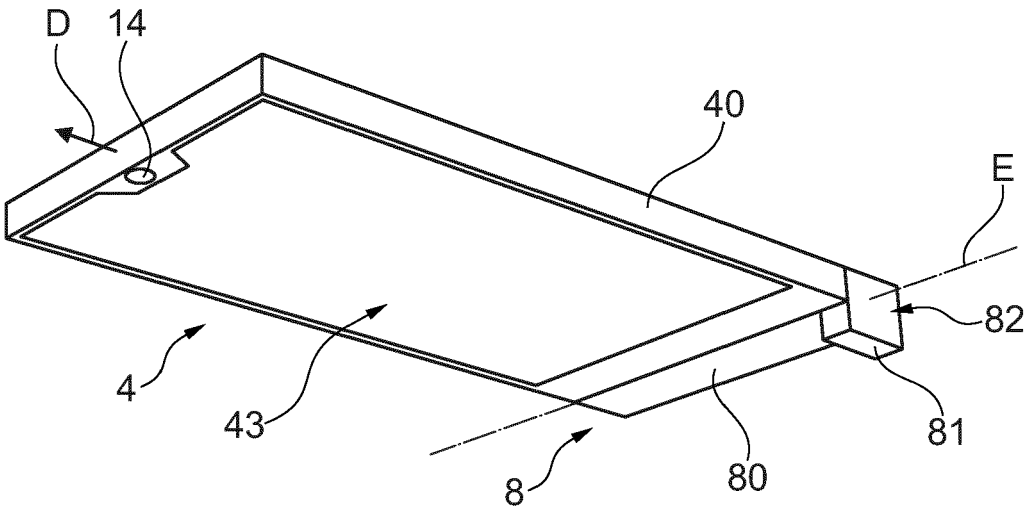

Fig. 2

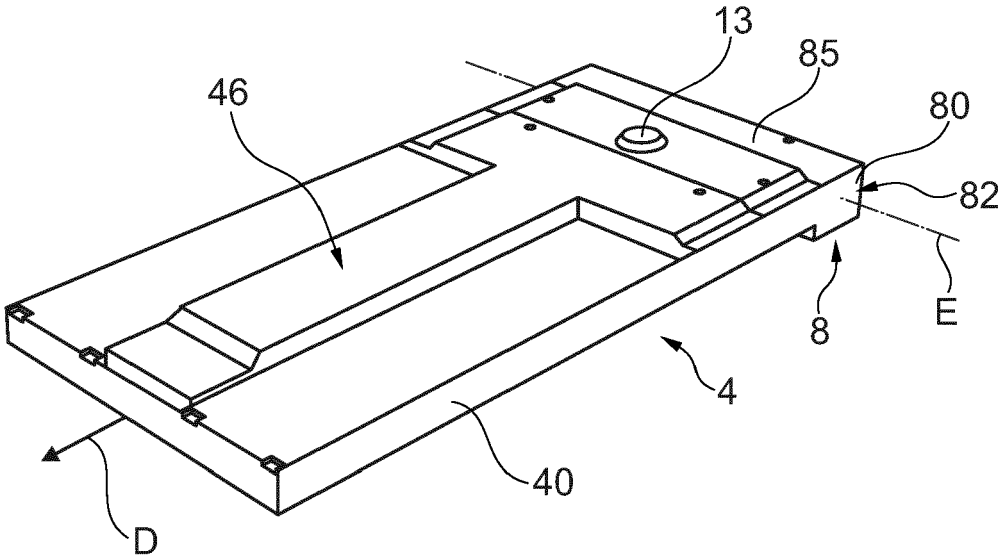

Fig. 3

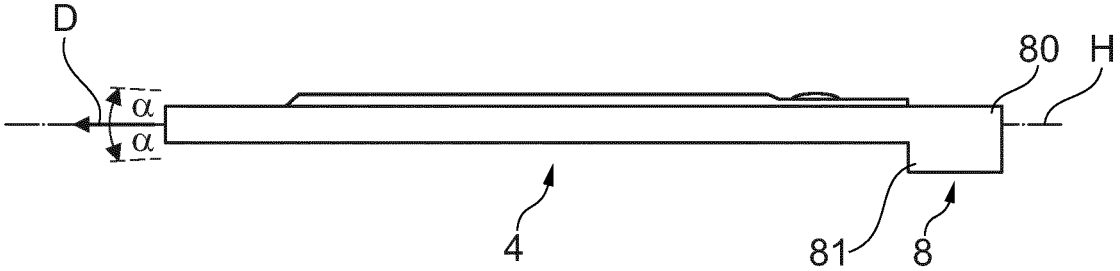

Fig. 4

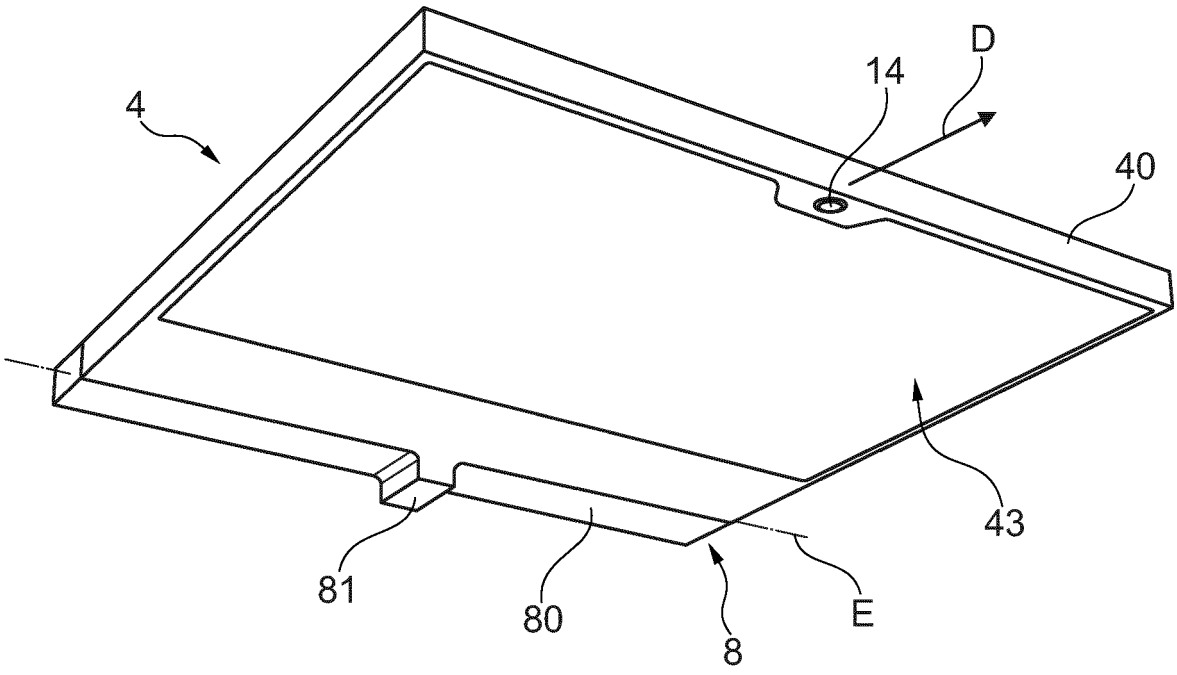

Fig. 5

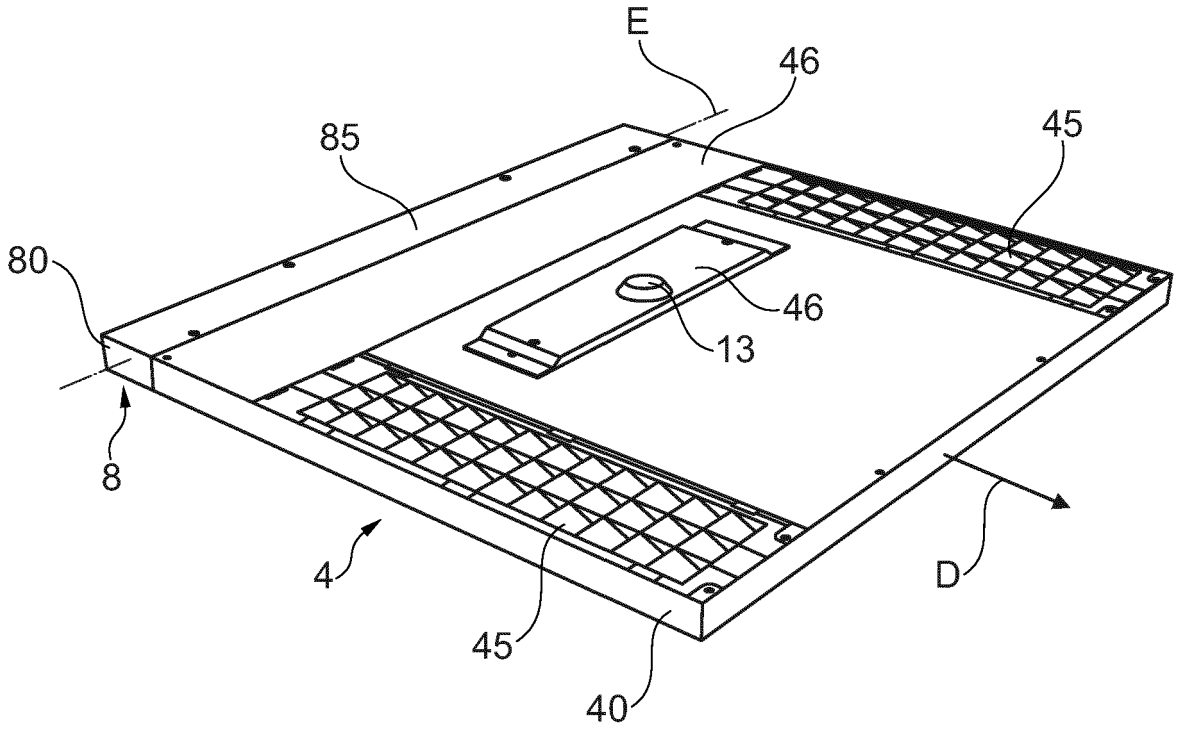

Fig. 6

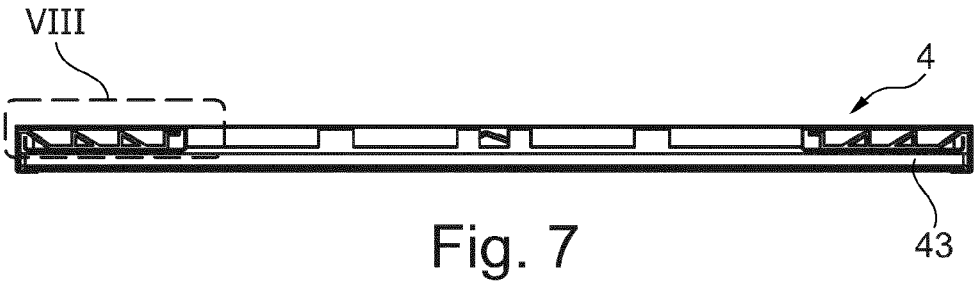

Fig. 7

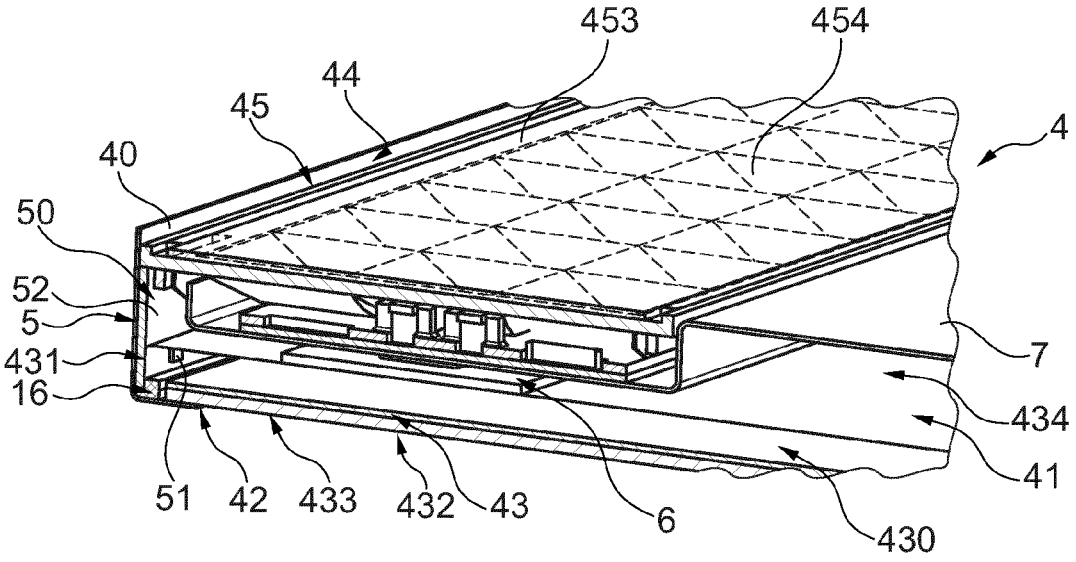

Fig. 8

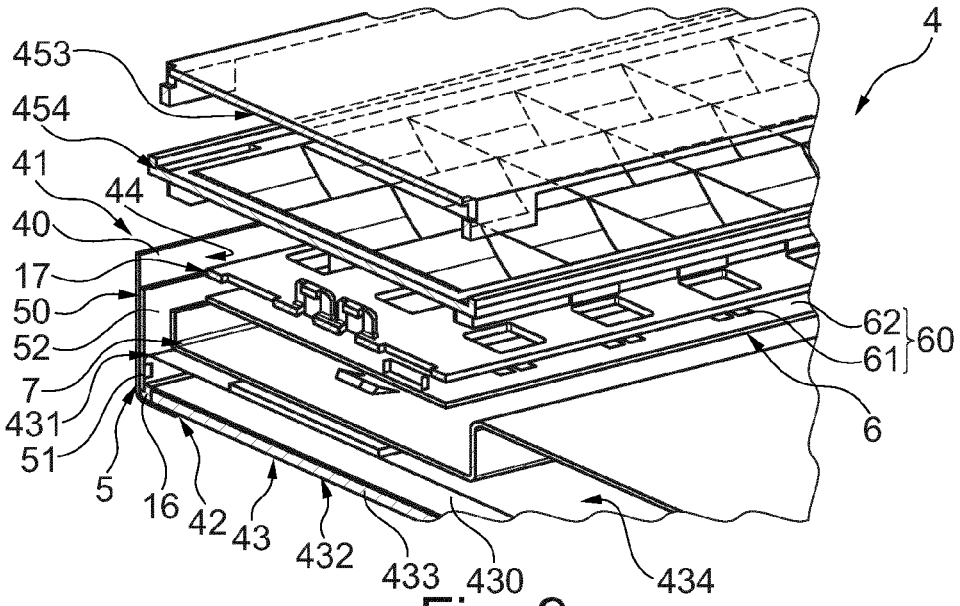

Fig. 9

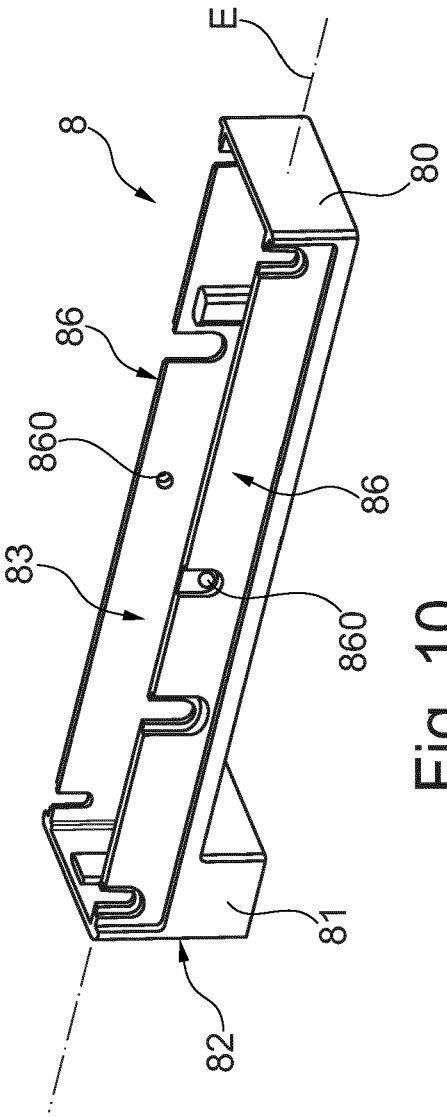

Fig. 10

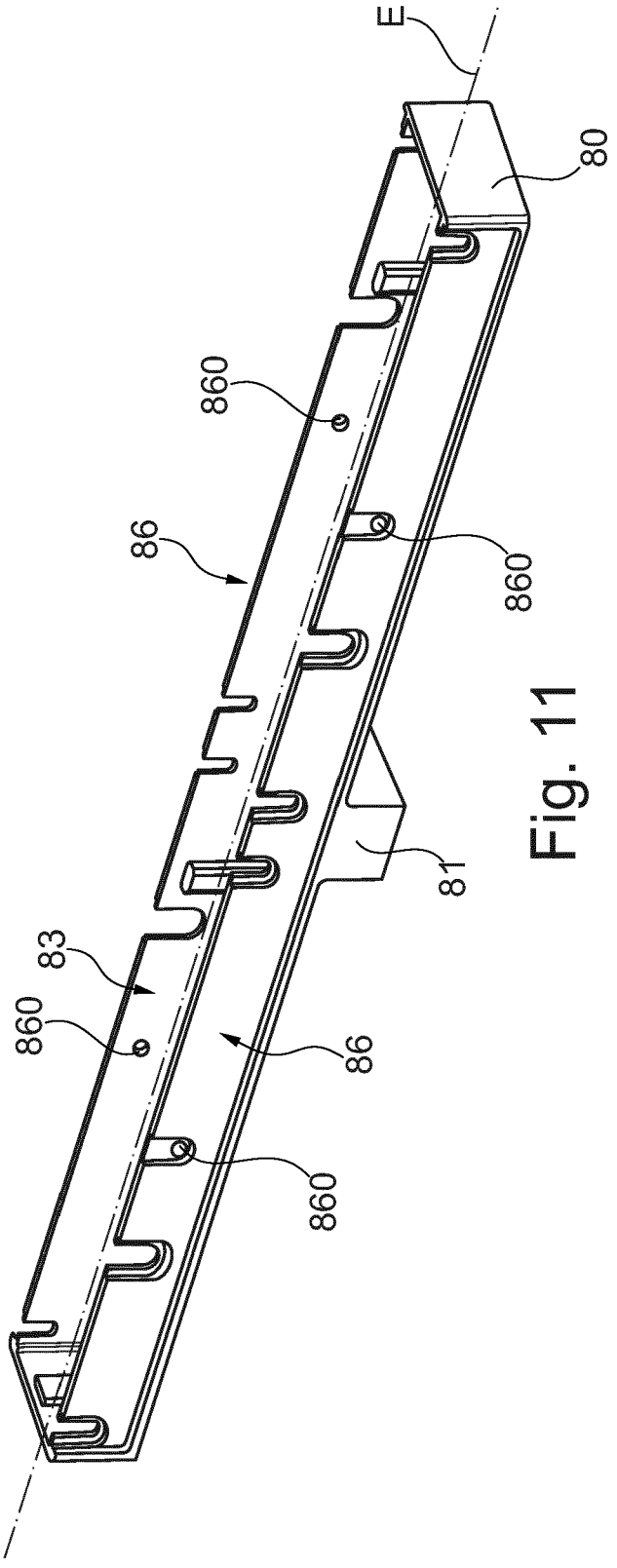

Fig. 11

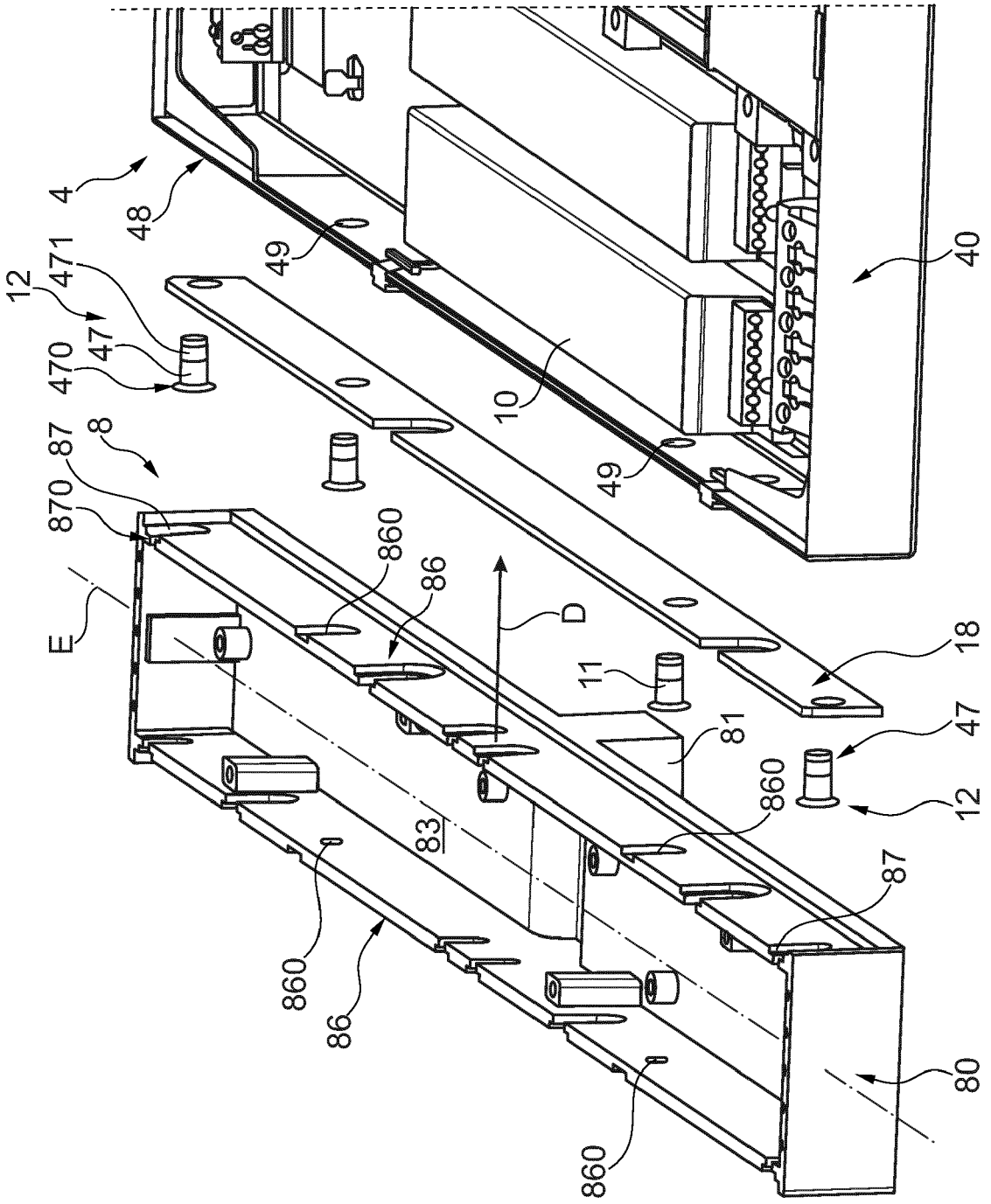
4
48
49
40
12
471
47
470
10
87
8
870
860
86
D
E
18
11
81
47
12
860
83
87
860
86
80
860

Fig. 12

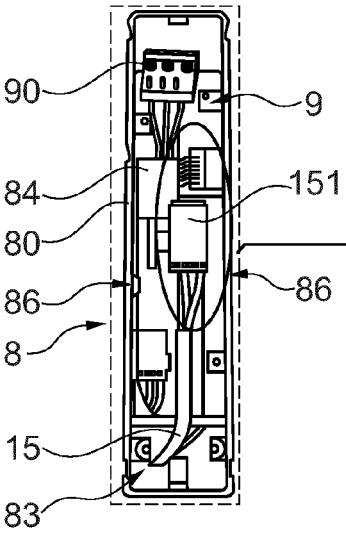

Fig. 16

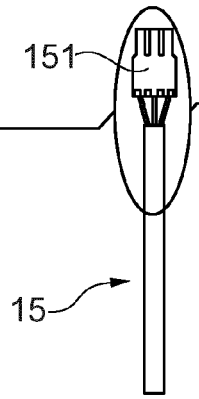

Fig. 15

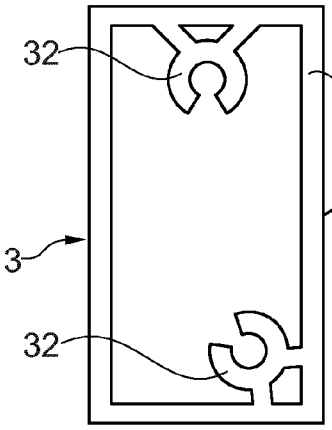

Fig. 14

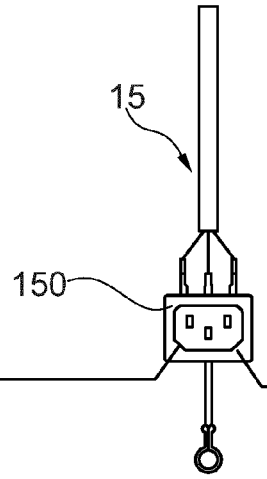

Fig. 17

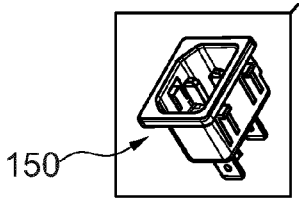

Fig. 18

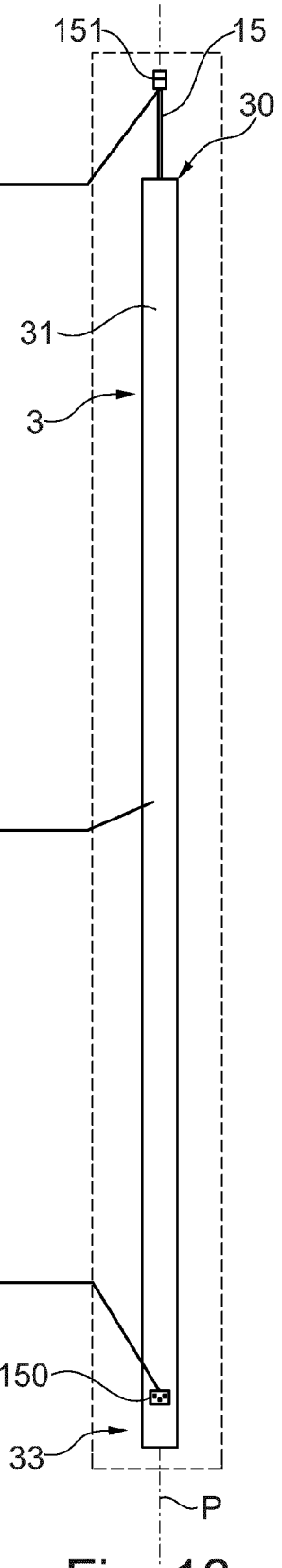

Fig. 13

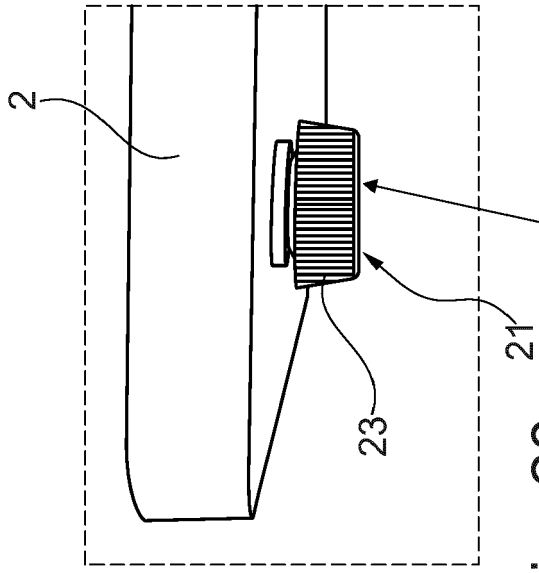

Fig. 20

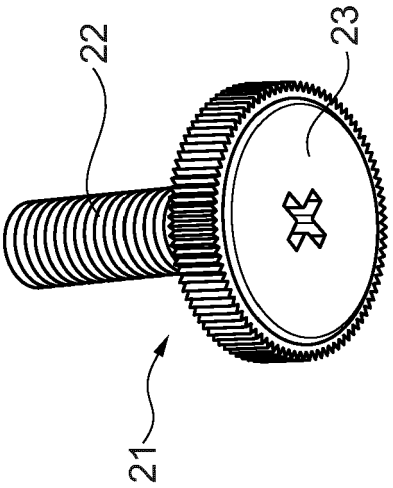

Fig. 21

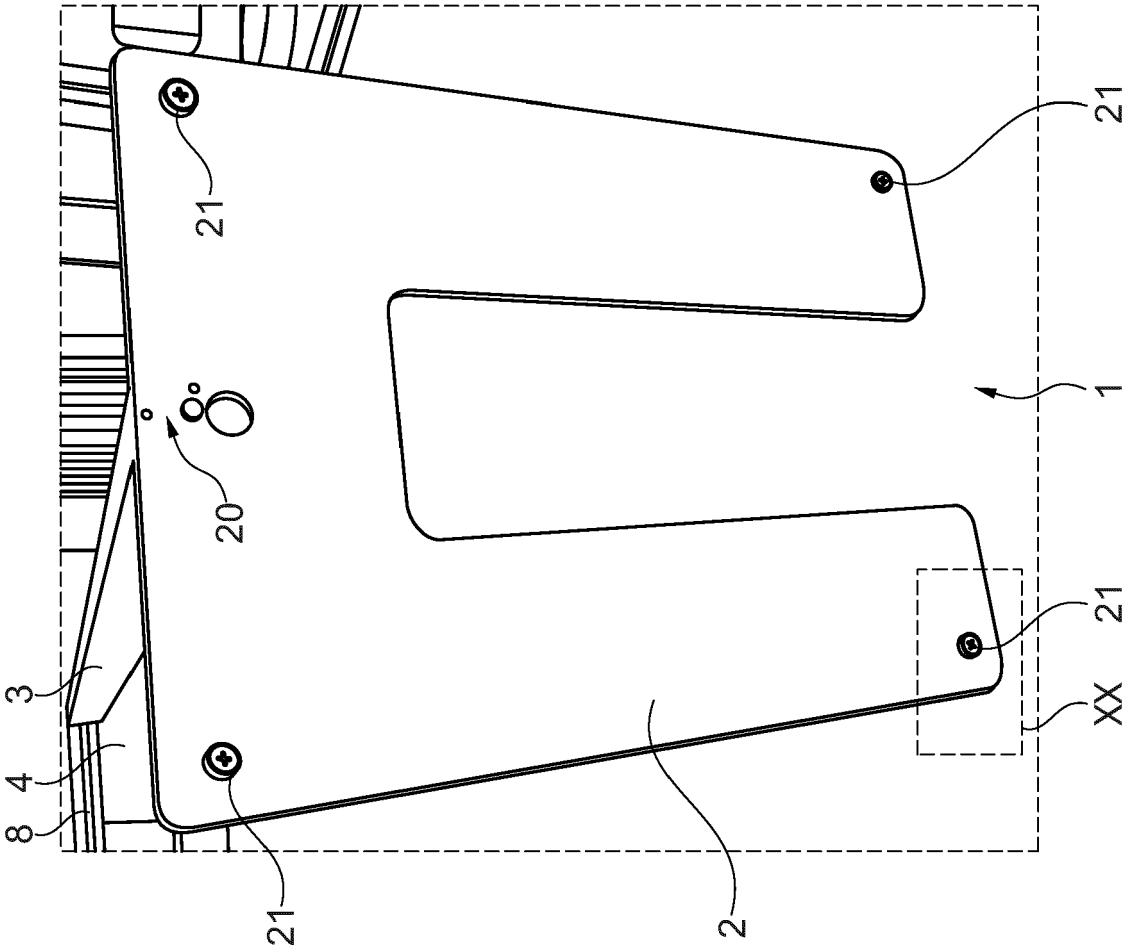

Fig. 19

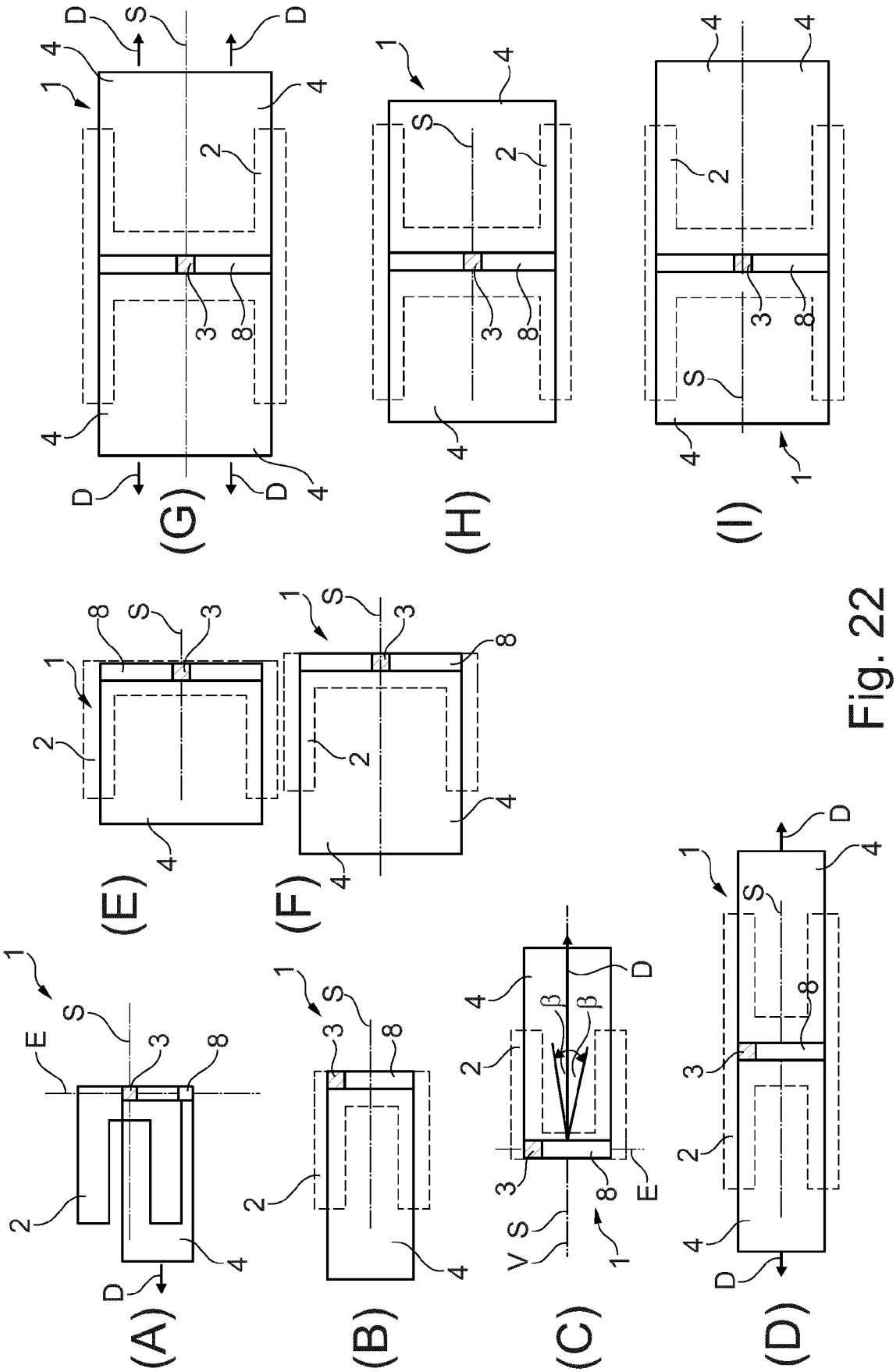

Fig. 22

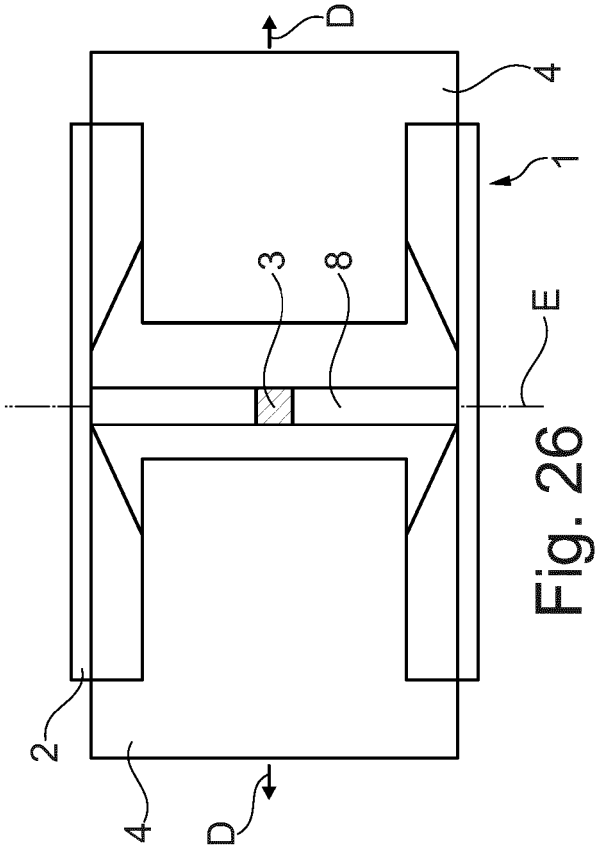

Fig. 26

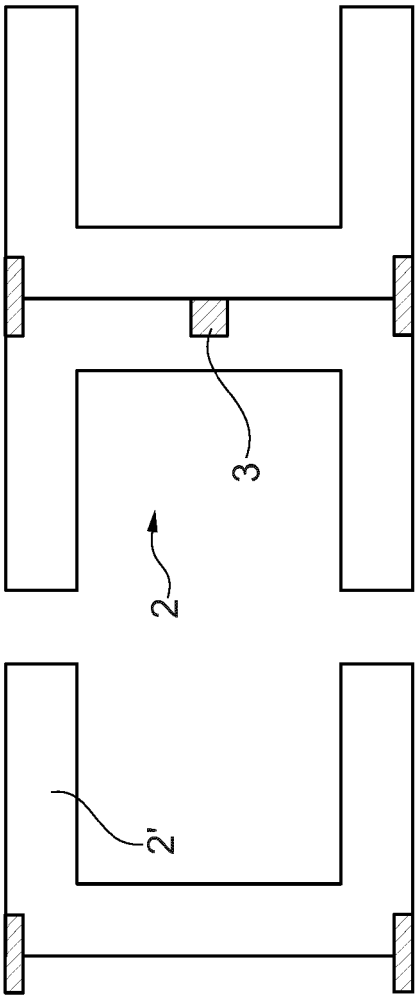

Fig. 25

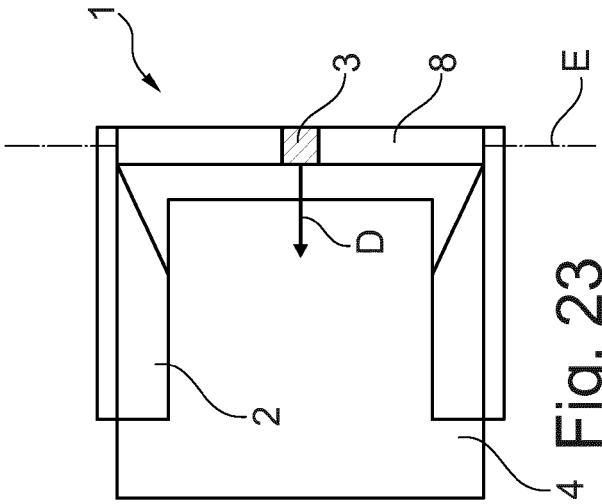

Fig. 23

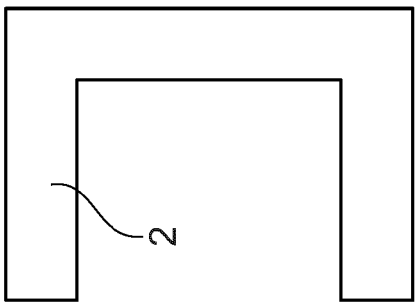

Fig. 24

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5280

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	US 2016/281968 A1 (SUNG CHIH-FENG [TW]) 29 September 2016 (2016-09-29) * paragraphs [0018] - [0021] * * figures 1-5 *	1-5,8-15	INV. F21S6/00 F21V17/00 F21V21/116 F21V23/00 F21V23/04
X	EP 3 527 871 A1 (BOZZOLA MARCO [IT]) 21 August 2019 (2019-08-21) * paragraphs [0013], [0028], [0029] * * figure 6 *	1-15	
X	WO 2006/020065 A2 (MULTI MEDIA ELECTRONICS INC [US]; BERNARDT GARY C [US] ET AL.) 23 February 2006 (2006-02-23) * figures 1, 3 *	1-4,6-15	
X	WO 2013/115611 A2 (HAN MINWOO [KR]) 8 August 2013 (2013-08-08) * figures 1, 2 *	1-6,8-15	
X	DE 10 2007 024362 A1 (STRUCTURELAB GMBH [DE]) 27 November 2008 (2008-11-27) * figure 9b *	1,4-15	

TECHNICAL FIELDS SEARCHED (IPC)

F21S
F21V

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 November 2022	Allen, Katie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 5280

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-11-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016281968 A1	29-09-2016	JP 2016181499 A	13-10-2016
		TW 201634866 A	01-10-2016
		US 2016281968 A1	29-09-2016
EP 3527871 A1	21-08-2019	NONE	
WO 2006020065 A2	23-02-2006	NONE	
WO 2013115611 A2	08-08-2013	KR 20130090441 A	14-08-2013
		WO 2013115611 A2	08-08-2013
DE 102007024362 A1	27-11-2008	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82