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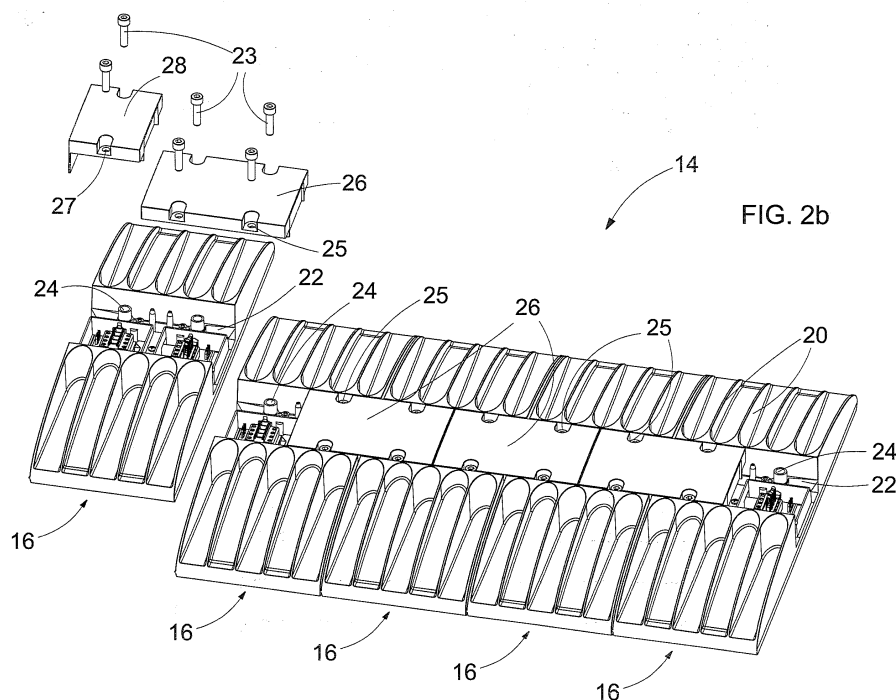
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(54) **Multifunction LED lighting device**

(57) A multifunction LED (Light Emitting Diode) lighting device suitable for being used as luminaire for outdoor environments or for indoor applications comprising a configurable and reconfigurable modular structure formed by at least one optical compartment or body (14) comprising one or more modules (16) inside whereof LED light sources are housed and apt to be attached with respect to a driver compartment inside whereof electrical

and electronic components are housed necessary for the functioning of the lighting device and suitable to be anchored with respect to a support, each module (16) comprising pairs of opposite pins or projecting appendages (24) whereon attachment blocks (26) are fitted to form a coupling with constraint between single adjacent modules (16) or between a module and the driver compartment.



Description

[0001] The object of the present invention is a multi-function LED (Light Emitting Diode) lighting device.

[0002] More particularly the present invention relates to a LED lighting device, suitable for use as luminaire in different scenarios/contexts both indoor and outdoor.

[0003] More particularly said lighting device is suitable for use as luminaire for parking areas, parks/gardens or pedestrian areas or residential green areas, for city and town roads, out-of-town roads and/or motorways, for billboards and road signs or another known type of sign positioned along the road route. Moreover the same device can be applied for the lighting of elements of street furniture such as façades of public and/or private buildings or the like for the purpose of enhancement or, further, the same device can be used also for interior applications such as the lighting of exhibition stands, public and/or private premises, hotel lobbies, offices and the like.

[0004] As is known, for the lighting of outdoor and indoor environments lighting devices are generally used having special and different features as a function of the specific area of use, of the different electrical safety requirements, of the technical lighting performances, modes of use and installation, etc.

[0005] As a consequence of this, different lighting appliances are provided for different applications.

[0006] For example, in the case of lighting of green areas, the lighting appliance is typically attached on the top of a post and the optics used must have a technical lighting distribution of the rotosymmetrical type suitable for covering a symmetrical area around the support post, while in the case of an application in an indoor environment the same technical lighting distribution can be obtained, for example, by attaching the lighting appliance to a ceiling fitting and not to a support post.

[0007] Therefore, in order to obtain and guarantee the same technical lighting distribution with the emitting surface of the lighting device always parallel to the walking surface it is necessary to use different lighting devices designed especially for the different application needs.

[0008] For this purpose lighting devices of the modular type are known which comprise modules, electrically and mechanically connected one to the other and whose number or arrangement varies as a function of the specific lighting features required.

[0009] For example the document US2013/0088864 describes a modular lighting appliance comprising a central portion with respect where to angled modular lighting elements can be connected with independent power supply and at least one container element coupled to said central portion.

[0010] The document US2013/0027935 refers to a lighting device of the modular type comprising a support structure with respect where to a plurality of modular cooling elements can be connected permanently, semi-permanently or removably, where to the light sources are attached which, via cables, are connected to the support

structure comprising the electronic components for the functioning of the device.

[0011] A lighting device of the modular type is also described in the document KR10-2009-0124643 and comprises a series of modules identical one to the other, attached one to the other by means of screws and comprised between two bodies suitable for defining a head and tail portion of the lighting device, with said modules which comprise the light sources of the LED type.

[0012] The lighting device described in the document EP260002355 comprises two or more LED modules connected and attached one to the other and with respect to a support element and, likewise, provided with an electrical cable for the electrical power supply.

[0013] A further known LED modular lighting device is described in the document US2010/0271804 in which the lighting modules comprise one end provided with a connection element of the male type and the opposite end with a connection of the female type, this in order to allow a securing of the modules one in respect of the other and of a module with a support element.

[0014] However these traditional documents have some major disadvantages linked to the fact that, although these are modular devices, they have disadvantages linked to the structural and/or assembly complexity as well as to the storage of the single modules.

[0015] The object of the present invention is that of obviating the disadvantages stated above. More particularly the object of the present invention is that of providing a multifunction LED lighting device which can be adapted and reconfigured as a function of the different lighting and application needs.

[0016] A further advantage is represented by the fact of providing a lighting device which is easy and convenient to mount/dismantle in the case of change of configuration, maintenance and/or repair or inspection.

[0017] A further object of the present invention is that of providing a lighting device such as to allow the containment of the storage costs.

[0018] A further object of the present invention is that of making available to users an LED lighting device suitable for guaranteeing a high level of resistance and reliability in time and such, moreover, as to be able to be easily and economically manufactured.

[0019] These and other objects are achieved by the device of the invention that has the features of claim 1.

[0020] According to the invention a multifunction LED (Light Emitting Diode) lighting device is provided comprising a modular structure which can be configured and reconfigured, formed by one or two optical compartments or bodies apt to be attached to a driver compartment suitable for being anchored with respect to a support and suitable for housing electrical and electronic components necessary for the operation of the lighting device and optional devices for the regulation of the light flow, the bodies having modular structure and inside whereof LED light sources are housed, comprising optional primary and/or secondary optics, said optical compartment or

body and driver compartment being independent one in respect of the other.

[0021] Advantageous embodiments of the invention are disclosed by the dependent claims.

[0022] The constructional and functional features of the multifunction LED lighting device of the present invention will be made clearer by the following detailed description, in which reference is made to the accompanying drawings which represent a preferred and non-limiting embodiment thereof, in which:

Figure 1 shows schematically an axonometric view from above of the multifunction LED lighting device of the present invention according to a preferred embodiment;

Figure 2 shows at schematic level an axonometric view from below of the lighting appliance as shown in Figure 1;

Figure 2B shows schematically a partially blown-up axonometric view of the lighting device according to the preferred embodiment as shown in the previous drawings;

Figure 3 shows schematically a plan view from above of a component element of the device of the invention;

Figure 4 shows schematically an assembly configuration comprising three component elements as shown in the previous drawing in a plan view from above;

Figure 5 shows schematically an axonometric view from below of a component element of the lighting device of the invention;

Figures 6 to 28 show schematically different modes of configuration and assembly of the lighting device of the invention and, more specifically: a configuration with framework suitable for assembly on a post (Figures 6 to 8), a configuration suitable for a post-top assembly (Figures 9 to 11), a projector assembly (Figures 12 to 15), ceiling fitting (Figures 16 to 19), with rigid suspension (Figures 20 to 22), with suspension with electrified bar connection (Figures 23 to 25) and a suspension assembly with support cables (Figures 26 to 28).

[0023] Referring to the aforesaid drawings, the multifunction LED lighting device of the present invention comprises substantially an optical compartment or body 14 whose interior houses the light sources defined by LED, the optional primary optics and the secondary optics or lenses apt to intercept the light beam emitted by the LED light sources and to reflect it according to the directions and the mode of technical lighting distribution required, with said optical compartment or body apt to be connected to a driver compartment provided with fittings/systems of anchorage to an attachment element defined, for example, by a post or wall, etc.

[0024] The driver compartment, typically made in aluminium or alloys thereof or another material suitable for

the purpose, houses the electrical and electronic components necessary for the functioning of the lighting device and the optional devices for the regulation of the light flow according to the specific environmental features (for example the devices for intelligent dimming, self-learning and similar functions).

[0025] This driver compartment has different shape and configuration as a function of the different type of attachment whereto the lighting device is destined, as will be described in detail here below.

[0026] The optical compartment or body 14 comprises one or more modules 16, all identical as regards size, structure and technical lighting features and defined by a container body 17 of substantially rectangular shape, made in aluminium, alloys thereof or another material suitable for the purpose, apt to house the electronic plates or boards whereon the LED light sources 18 are placed optionally provided with primary optics or lenses (integrated with the LEDs) for the radiation and the diffusion of the light emitted by the same and with secondary optics or lenses having the function of intercepting the light beam emitted by the LEDs and of reflecting it according to the technical lighting distribution required (for example a rotosymmetrical distribution).

[0027] On the upper outer face of each container body 17 and away therefrom a plurality of fins 20 are developed, formed in a continuous or alternating way, with equal or different heights, arranged parallel one to the other or staggered and having the function of allowing the passage of air with function of cooling and dissipation of the heat developed by the lamp.

[0028] The central region of each container body 17, on the opposite side with respect to that of housing of the LED light sources 18, has a pocket 22, extended longitudinally between two end faces of each container body 17 and open at the same, provided with a plurality of projecting pins 24 (in the preferred embodiment as per the drawings there are four projecting and opposite pins for each container body 17) or appendages or similar mechanical means apt to allow the coupling between single modules 16 and their assembly by means of attachment blocks 26 apt to engage with the projecting pins 24 or their equivalently known means of retaining of the container body 17 of two adjacent modules 16 so as to form a stable coupling between adjacent modules (as schematised in Figure 1) or between a module and the driver compartment.

[0029] The attachment blocks 26 are placed with connection between modules 16 adjacent one to the other and arranged one in succession to the other (as schematised in Figures 1, 2 and 2b) or between a module 16 and the driver compartment for connection of the same; in particular a single attachment block 26 engages with a pair of opposite projecting pins of a module 16 and with a pair of opposite projecting pins of an adjacent module, fitting with simultaneous closure of a portion of pocket 22 of a module 16 and of the module immediately adjacent thereto; in this way the single block 26, fitted above the

pocket 22 of two adjacent and successive modules 16, is attached by means of screws or rivets or similar suitable retaining means inserted in holes 25 of said block to define a stable connection between the aforementioned modules 16.

[0030] The device likewise comprises a closure block 28 which engages with the projecting pins 24 or retaining elements of the last module or outermost module 16, with said closure block 28 which does not have the function of allowing a stable coupling between two adjacent modules, but is simply suitable for guaranteeing the closure and the sealing of the pocket 22 of said last or outermost module 16 of the sequence; said closure block 28 is fixed in position by means of screws 23 or rivets or similar retaining elements inserted in holes 27.

[0031] Said attachment blocks 26 or said closure block 28 are made in aluminium or alloys thereof, in plastic material or in another known material suitable for the purpose.

[0032] These attachment blocks 26 and the closure block 28 perform, likewise, the function of closing above the pocket 22 of the single modules 16 and the driver compartment whereto the block of modules is connected, acting as casing and guaranteeing, at the same time, an aesthetic uniformity and continuity of the lighting device.

[0033] The following is a description, by way of an example, of some application configurations of the multi-function lighting device of the invention wherein the one or more modules are attached to the driver compartment according to the methods described above in detail.

[0034] Referring to Figures 6 to 8 the lighting device of the invention is schematised, attached on the top of a post 36 according to a configuration of the "framework" type.

[0035] According to this assembly configuration the lighting device is defined by a driver compartment 12 constituted by a container element 30 (apt to house the electrical and electronic components necessary for the functioning of the lighting device) closed above by means of a cover 32 and hinged with respect to a shank 34 apt to couple with the upper end or top of the post 36 and by an optical compartment or body 14 defined by one or more modules 16 attached to the driver compartment 12, on the opposite side with respect to that of connection to the post, arranged in succession one to the other, on a same plane and away from said driver compartment (in the embodiment shown in the drawings, five modules arranged in succession are schematised); in particular the innermost module is adjacent to the driver compartment 12 and restrained thereto by means of an attachment block 26, the further adjacent modules are restrained one to the other by means of the same attachment blocks 26, with the outermost module provided with the closure block 28.

[0036] Referring to Figures 9 to 11 the lighting device of the invention is schematised, attached to the top of a post 38 according to a configuration of the post-top type.

[0037] In this configuration a driver compartment 12B

comprises a container element 40 closed above by means of a cover and from whose lower face, opposite the upper one closed by said cover, a shank 44 develops, formed integrally with the container element 40 or attached thereto with known retaining means (for example a threaded connection) and apt to be fitted on the top or upper end of the post 38, as schematised in Figure 11.

[0038] In the preferred embodiment as per the aforesaid drawings the lighting device in the post-top configuration comprises, for example, two optical compartments or bodies 14 opposite one to the other and arranged laterally to the driver compartment 12B, with each optical compartment comprising one or more modules 16 arranged in succession one to the other, adjacent on a same plane and away from the driver compartment arranged in a central position. The arrangement of the optical compartments with respect to the central driver compartment can be symmetrical (optical compartments with equal number of modules) or asymmetrical (optical compartments with different number of modules), this as a function of the specific technical lighting needs. In particular, with reference to Figures 9 and 10, one of the optical compartments comprises two modules 16, while the other one is defined by a single module 16 attached to the driver compartment.

[0039] The methods of restraining of a module with respect to the adjacent one and with respect to the driver compartment 12B are similar to those described previously and, therefore, will not be described further.

[0040] Figures 12 to 15 show schematically the lighting device of the invention in a configuration of assembly of the "projector" type suitable for wall attachment (Figure 14) or floor/ground attachment (Figure 15).

[0041] In this configuration a driver compartment 12C comprises a container element 46 closed above by a cover 48 and at whose opposite side edges a bracket 50 is hinged, apt to allow the wall or floor attachment of the lighting device and its orientation in order to direct the light beam generated by the light sources in the directions required.

[0042] One or more modules 16 defining the optical compartment or body 14 are attached to the driver compartment 12C on the opposite side with respect to that of the bracket 50 and are arranged adjacently, on a same plane and in succession one to the other.

[0043] Said one or more modules are attached one to the other and with respect to the driver compartment 12C in accordance with the methods already previously described (in the embodiment as per the drawings a lighting device is schematised comprising five modules 16).

[0044] Referring to Figures 16 to 18 an embodiment of the lighting device of the invention is shown in a configuration of assembly of the "ceiling fitting" type suitable, for example, for ceiling attachment.

[0045] According to this method of assembly the lighting device comprises a first body 12D or driver compartment arranged centrally, laterally whereto two opposite optical compartments or bodies 14 are attached.

[0046] The driver compartment 12D comprises a container element 52 apt to house the electrical and electronic components of the lighting device, closed above by a cover 54 and provided with a transverse bracket 56 suitable for allowing the attaching of the lighting device to the ceiling or another method of suspension (as schematised in Figure 19).

[0047] Each optical compartment or body 14 attached to the driver compartment 12D is defined by one or more modules 16, with said number of modules which can be different in each second optical compartment or body (symmetrical or asymmetrical configuration of the optical compartments with reference to the driver compartment centrally arranged) as a function of the specific technical lighting needs; with particular reference to the embodiment as per the drawings the lighting device comprises an optical compartment or body 14 defined by a single module 16 and an optical compartment or body 14 defined by two modules 16.

[0048] The single modules are stabilised one with respect to the other and with respect to the driver compartment in a similar manner to what was described previously.

[0049] Figures 20 to 22 illustrate the lighting device of the invention in a configuration of use of the "rigid suspension" type, for example a wall/ceiling suspension.

[0050] In this configuration of assembly of the lighting device a driver compartment 12E comprises a container element 58 closed above by a cover and provided with a bracket 60 having the function of hooking to a ceiling (Figure 22) and below which is attached the optical compartment or body 14 comprising one or more modules 16.

[0051] Figures 23 to 25 show schematically the lighting device of the invention in an application configuration suitable for connection with respect to an electrified bar 62.

[0052] The lighting device, in this case, has an assembly configuration substantially similar to that of the "rigid suspension" type previously described with the driver compartment 12E which is provided above with a bracket 60 with eyelets 64 apt to engage with hooks 66 attached to the electrified bar in order to be able to suspend the lighting device.

[0053] The same lighting device of the invention can also be assembled in a configuration suitable for a rigid suspension by means of support cables 68, as schematised in Figures 26 to 28.

[0054] According to this configuration a driver compartment 12F and the optical compartment or body 14 are not in direct contact one with the other but instead connected at a predefined distance or adjustable by means of support cables 68 and a cable 70 for the transmission of the electrical power supply.

[0055] Said first body 12F or driver compartment comprises a container element 73 apt to be secured, for example, to a ceiling by means of an element 71, while the optical compartment or body 14 comprises one or more modules 16 connected one with respect to the other ac-

cording to what is described in detail previously.

[0056] As can be seen from the above the advantages that the device of the invention achieves are clear.

[0057] The lighting device of the present invention has the advantage of being provided with an optical part (optical compartment) completely unrestrained and independent of the part used for support (driver compartment) and provided with electrical and electronic components necessary for the functioning of the lighting device and this allows the creation of different application configurations, simply by changing the driver compartment (support element); moreover, by varying the number of modules of the optical compartment it is possible to modify the technical lighting features of the lighting device by varying, for example, the distribution of the light beam.

[0058] Further advantageous is the fact that the optical part is of the modular type, with modules all identical one to the other as regards shape, structure, dimensions and technical lighting features which can be combined in a different way as regards quantity and positioning with respect to the support part or driver compartment as a function of the different and specific configurations dictated by the specific technical lighting needs.

[0059] Further advantageous is the fact that the modular structure of the lighting device allows an easy assembly and/or replacement of the component elements in the case of malfunctioning or failure; in fact it is sufficient to operate on the single modules or on the driver compartment in a totally separate manner.

[0060] A further advantage is represented by the fact that the modular structure of the lighting device of the invention allows containing of the storage and warehousing costs, bearing in mind the fact that in order to vary the configuration of the lighting device or in order to modify the technical lighting features the replacement of the device as a whole is not required, but instead a redefinition of the number and arrangement of only the modules or the sole replacement of the support element or driver compartment.

[0061] Although the invention has been described above with particular reference to a preferred embodiment given solely by way of a non-limiting example, numerous changes and variations will appear clear to a person skilled in the art in light of the description given above. The present invention intends, therefore, to embrace all the modifications and the variations that fall within the scope of the following claims.

Claims

1. A multifunction LED (Light Emitting Diode) lighting device suitable for being used as luminaire for outdoor environments such as parking areas, parks/gardens, etc., for the lighting of street furniture elements or for indoor applications such as lighting of exhibition stands, public and/or private premises, hotel lobbies, offices and the like, **characterised in**

that it comprises a configurable and reconfigurable modular structure formed by at least one optical compartment or body (14) comprising one or more modules (16) inside whereof LED light sources (18) are housed and apt to be attached with respect to a driver compartment (12, 12B, 12C, 12D, 12E, 12F) inside whereof electrical and electronic components are housed necessary for the functioning of the lighting device and suitable to be anchored with respect to a support, each module (16) comprising pairs of opposite pins or projecting appendages (24) whereon attachment blocks (26) are fitted to form a coupling with constraint between single adjacent modules (16) or between a module and the driver compartment.

2. The lighting device according to claim 1, **characterised in that** the modules (16) are all identical one to the other in shape, size and technical lighting features.
3. The lighting device according to claim 1 or 2, **characterised in that** each module (16) is defined by a container body (17) of a substantially rectangular shape, provided on the upper outer face and away therefrom with a plurality of cooling fins (20) developed in a continuous or alternating way, with equal or different heights, arranged parallel to each other or staggered.
4. The lighting device according to any one of the preceding claims, **characterised in that** the pairs of opposite pins or projecting appendages (24) are formed in a pocket (22) formed in the central region of each container body (17) and longitudinally extended.
5. The lighting device according to one or more of claims 1 to 4, **characterised in that** it comprises closure blocks (28) for the closure of a portion of pocket (22) at the outer end portion of a single module (16) constrained in a more external position with respect to an adjacent module (16) or to the driver compartment.
6. The lighting device according to claims 1 and 5, **characterised in that** the attachment blocks (26) and the closure blocks (28) define a casing for covering/closing the pocket (22) of each module (16).
7. The lighting device according to any one of the preceding claims, **characterised in that** the driver compartment comprises a container element (30, 40, 46, 52, 58, 73) suitable for housing the electrical and electronic components necessary for the operation of the lighting device, is closed by means of a cover and comprises optional attachment means with respect to supports of the post, wall, floor or ceiling

type for a rigid or suspension connection.

8. The lighting device according to any one of the preceding claims, **characterised in that** the optical compartment or body (14) and the drive compartment (12, 12B, 12C, 12D, 12E, 12F) are made in aluminium or alloys thereof or another suitable material.
9. Use of the modules (16) and of the driver compartment (12, 12B, 12C, 12D, 12E, 12F) to vary the technical lighting features and the application configuration of a lighting device according to any one of the preceding claims, connecting and constraining said one or more modules in succession one to the other and to the driver compartment by means of attachment blocks (26) fitted above pairs of opposite projecting pins (24).

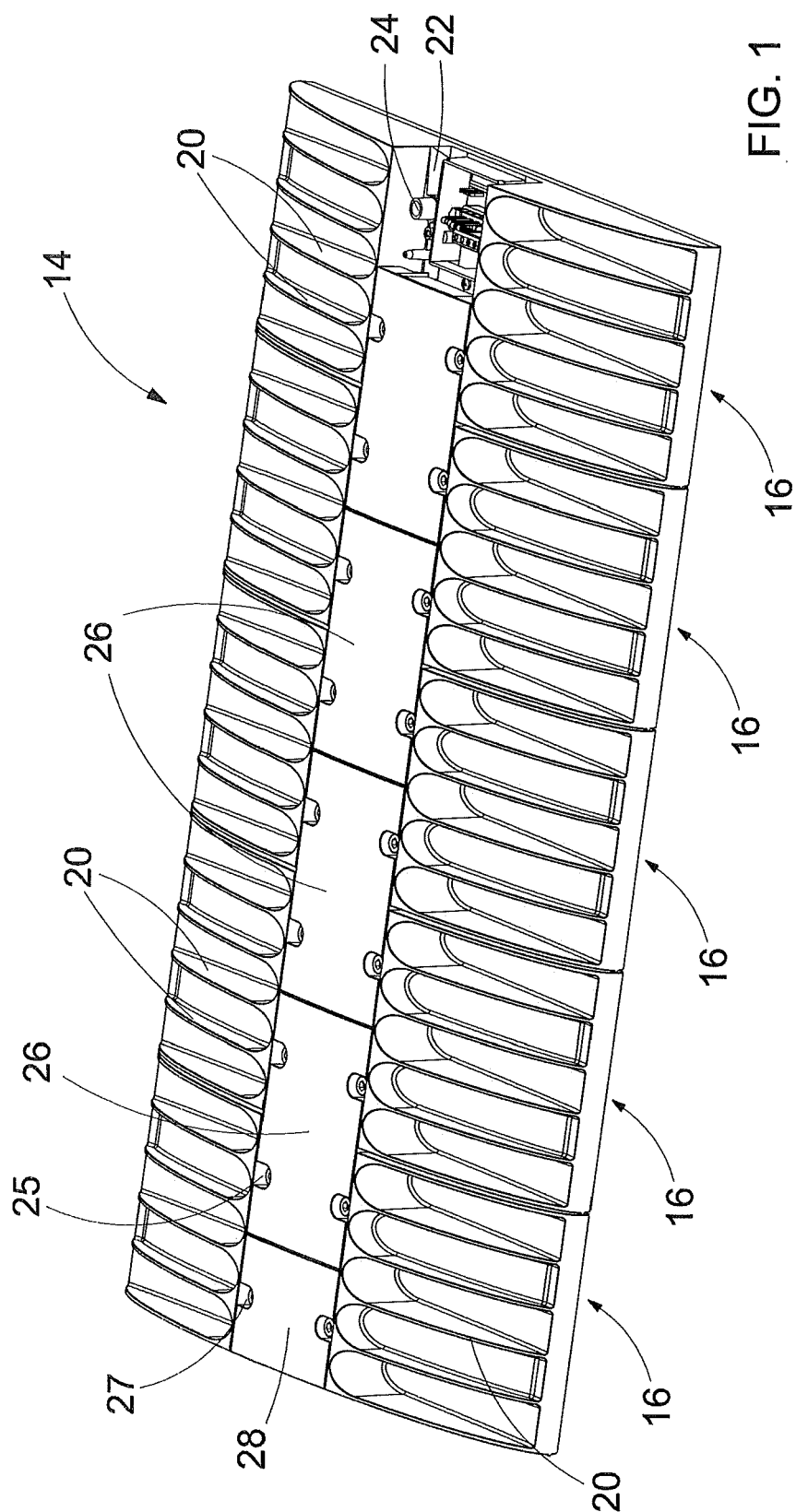


Fig. 1

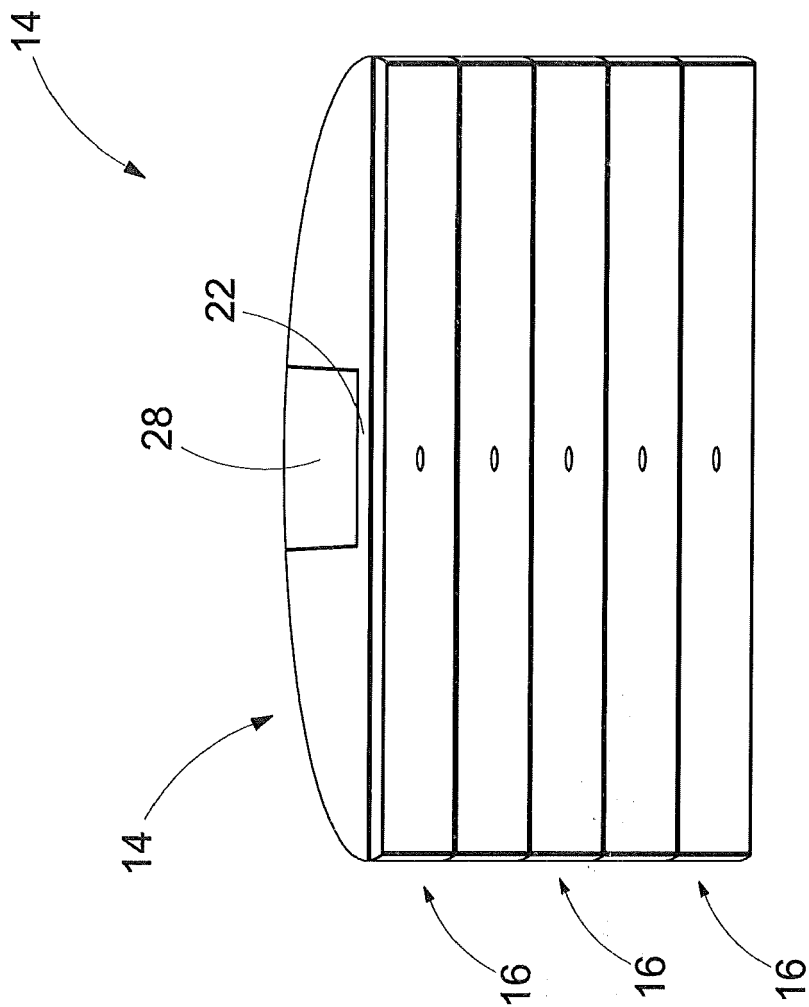
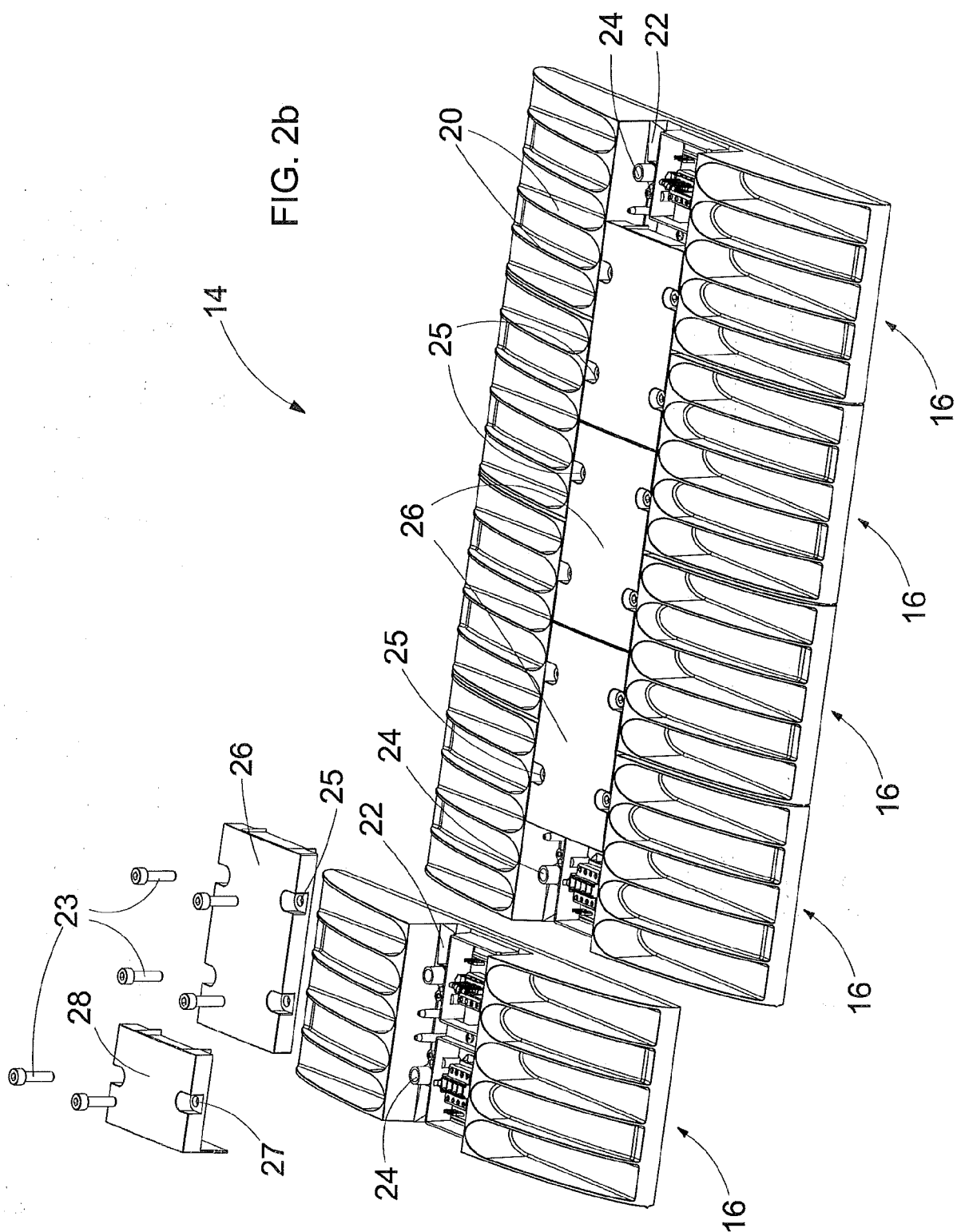


FIG. 2



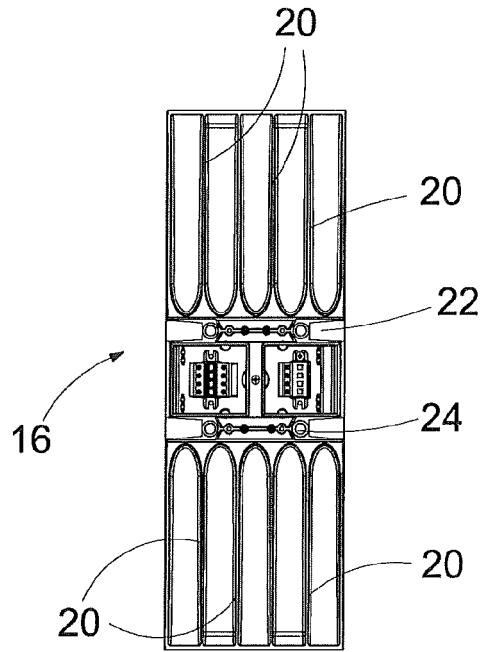


FIG. 3

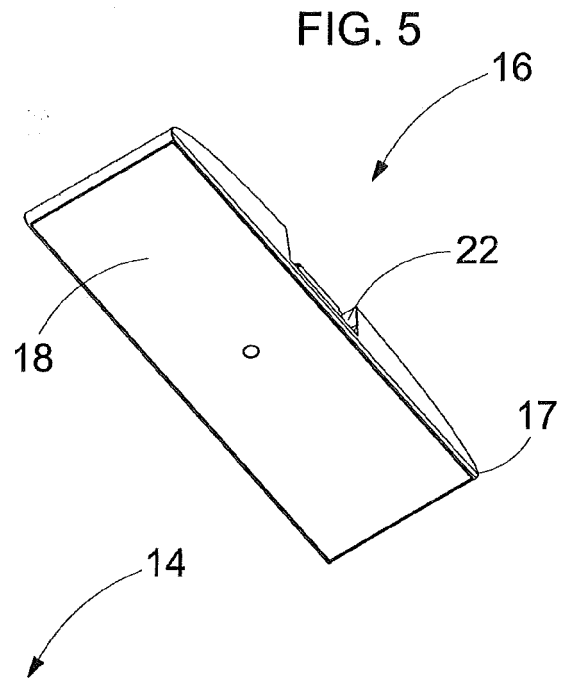


FIG. 5

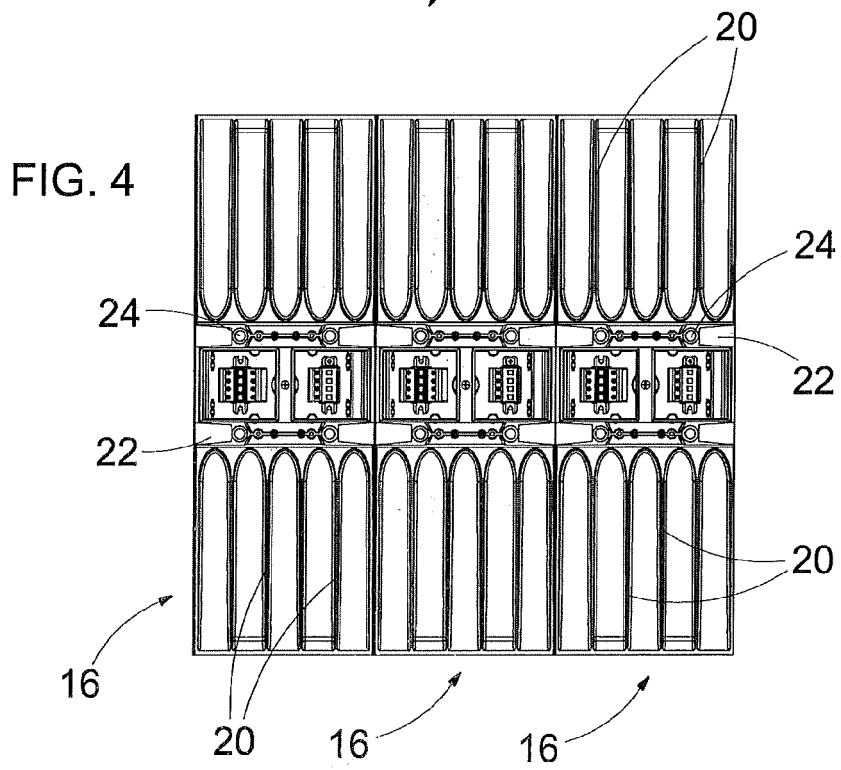
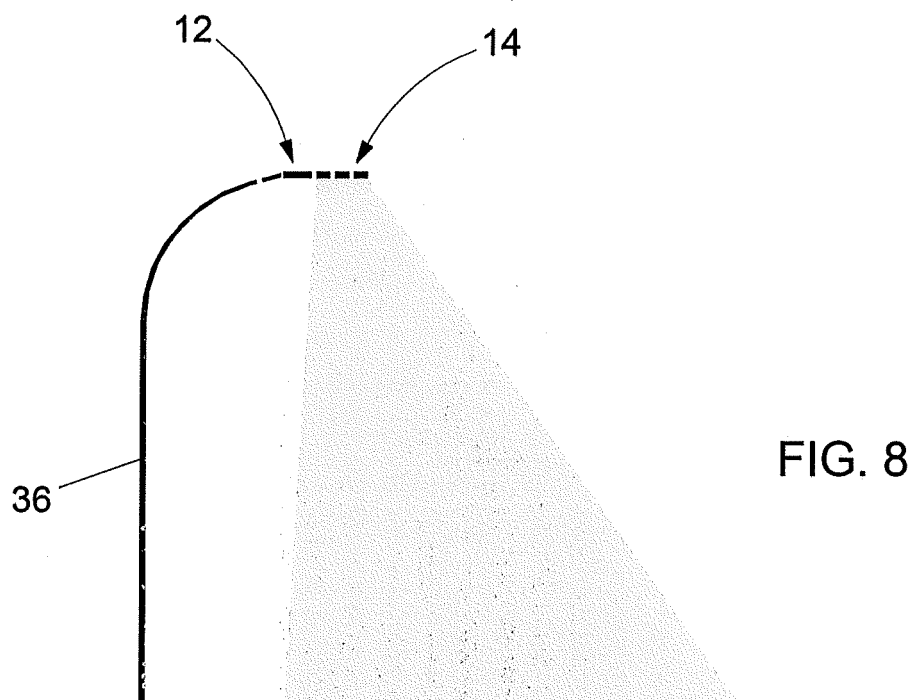
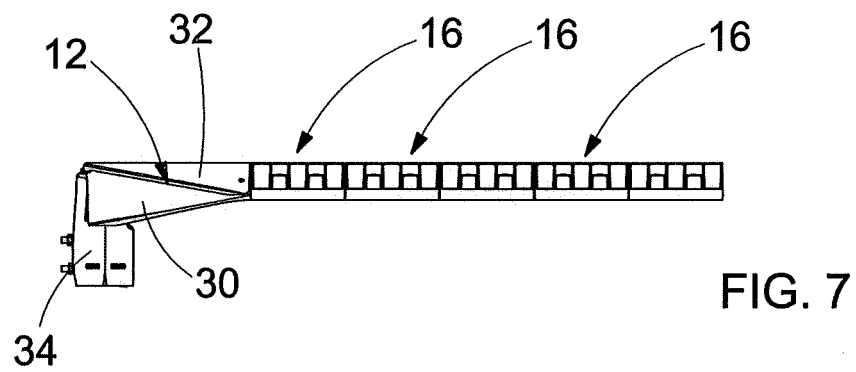
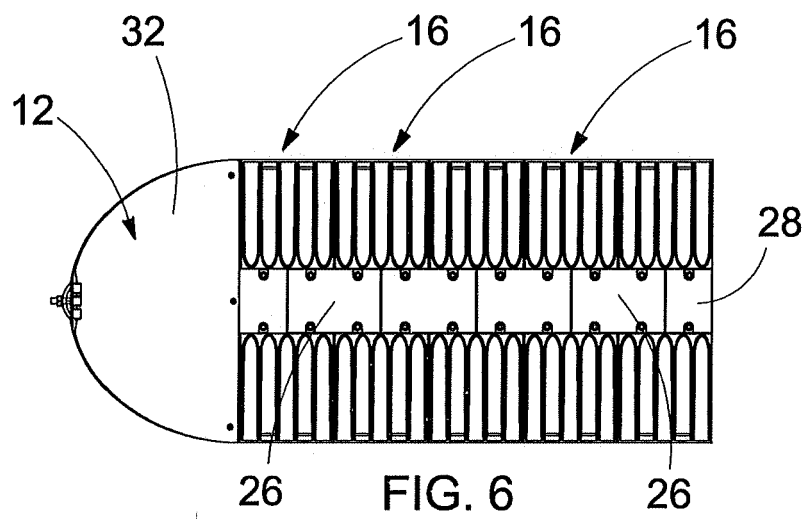


FIG. 4



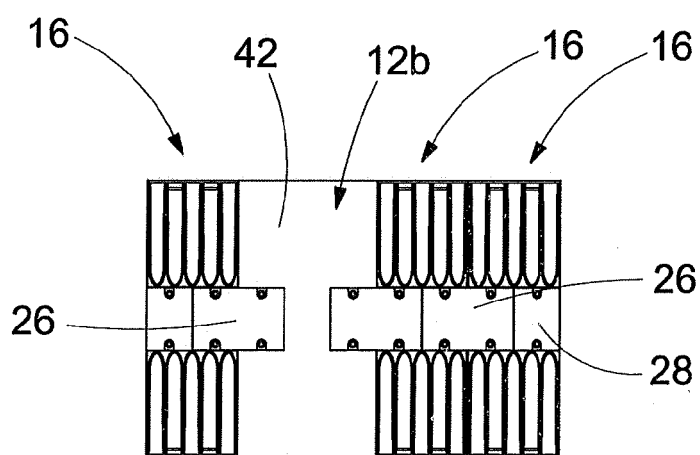


FIG. 9

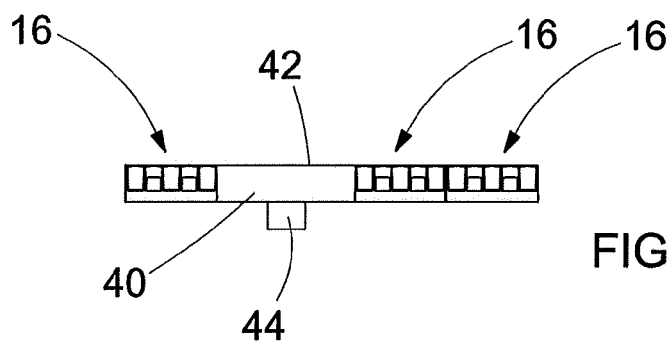


FIG. 10

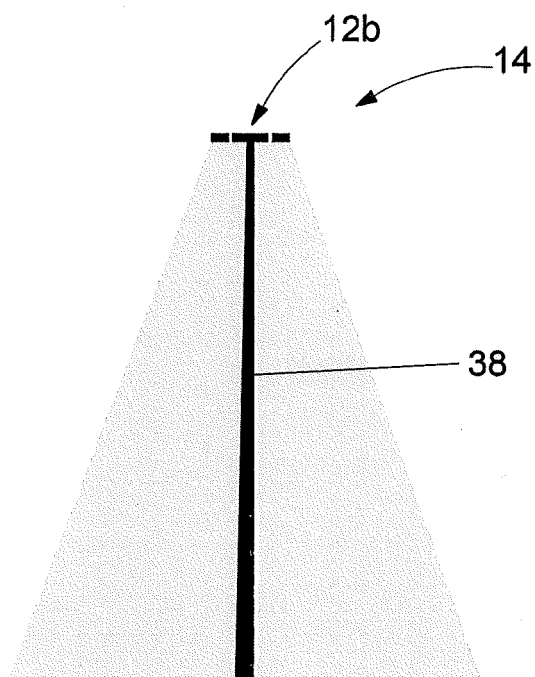
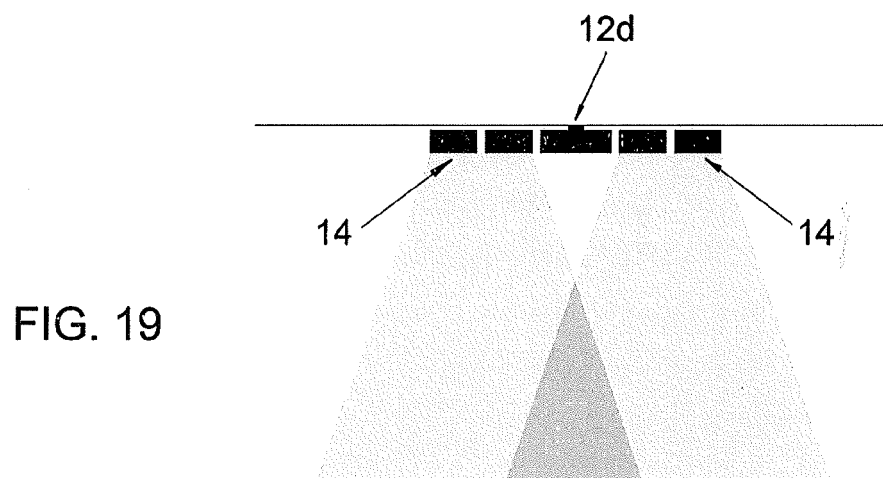
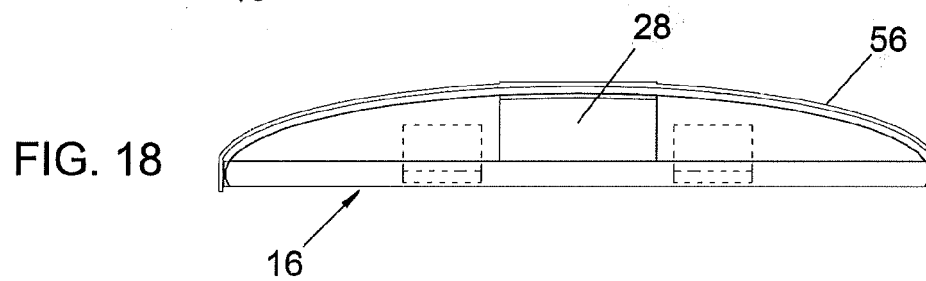
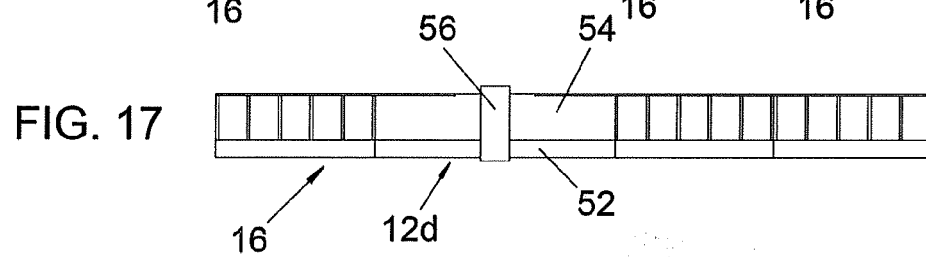
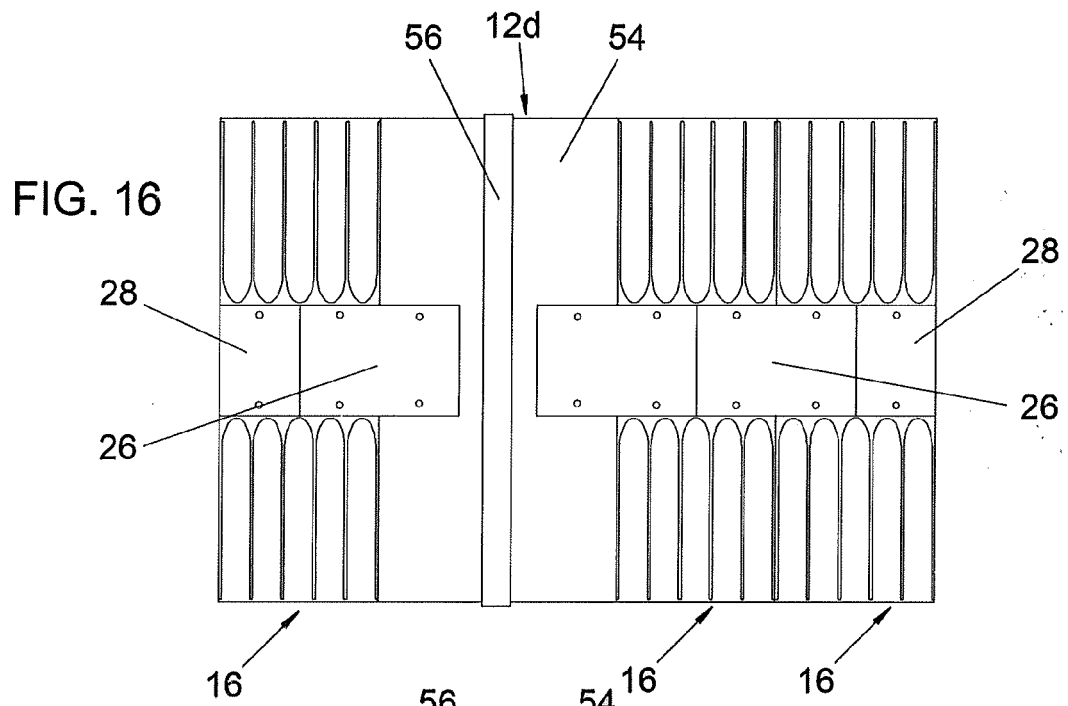
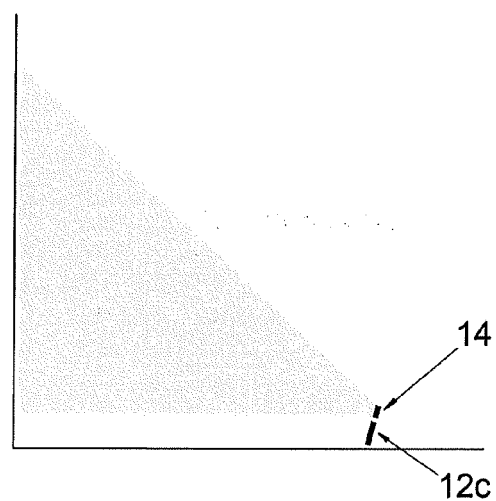
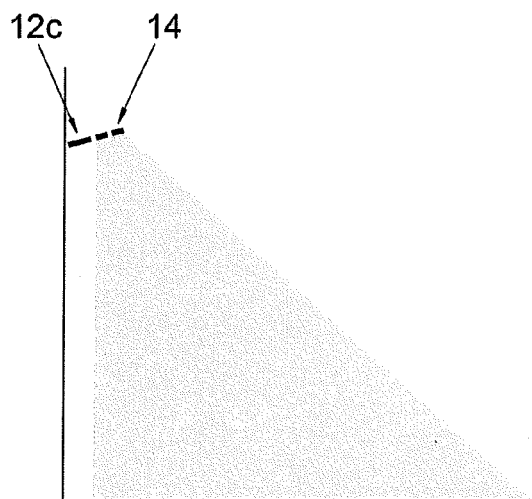
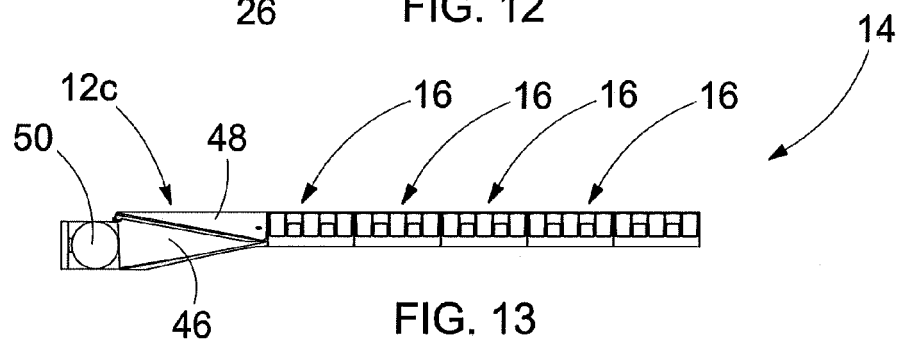
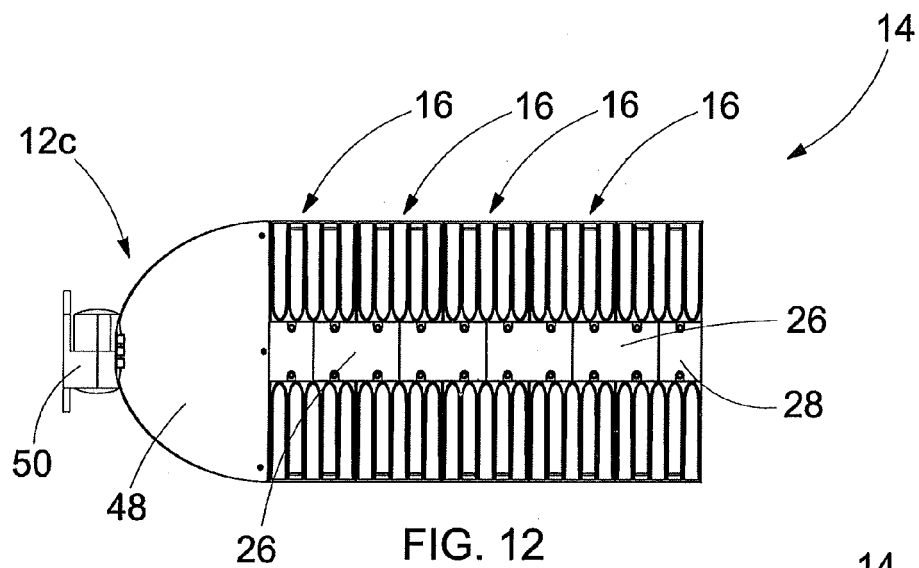


FIG. 11





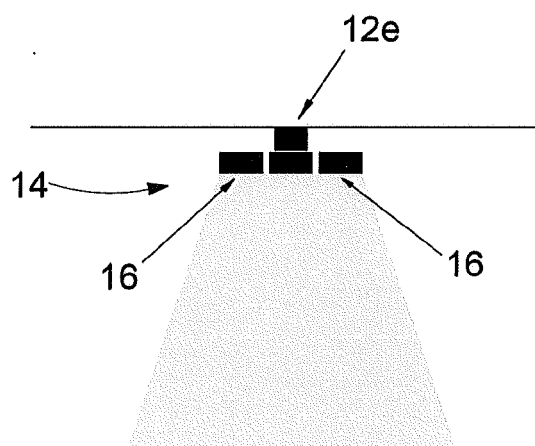
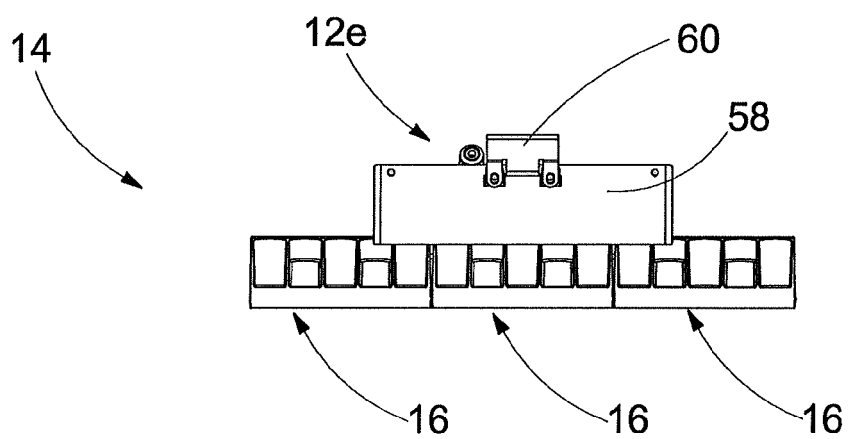
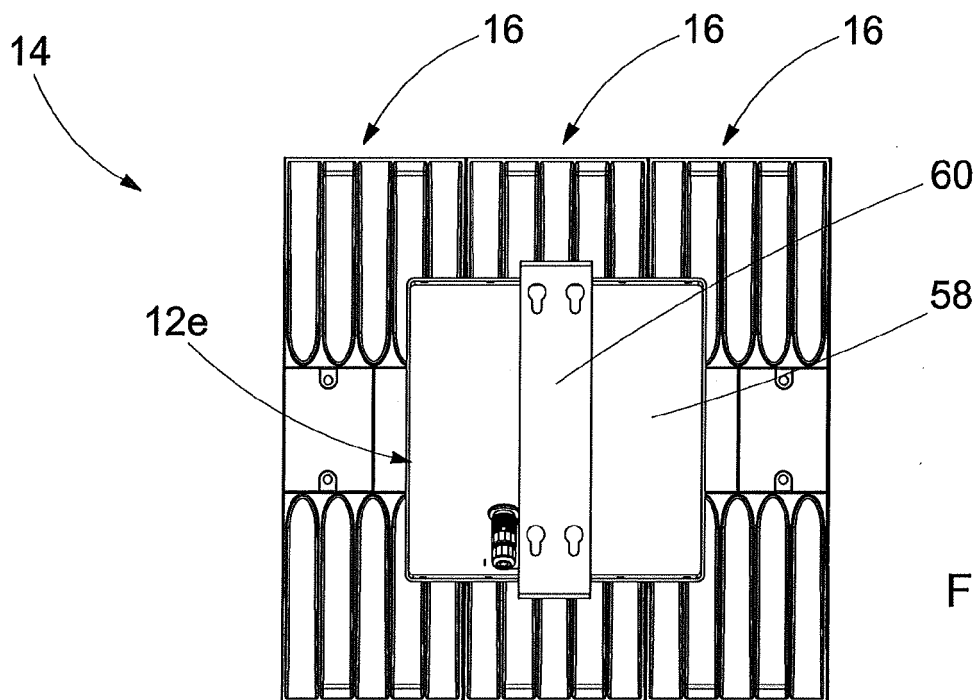


FIG. 23

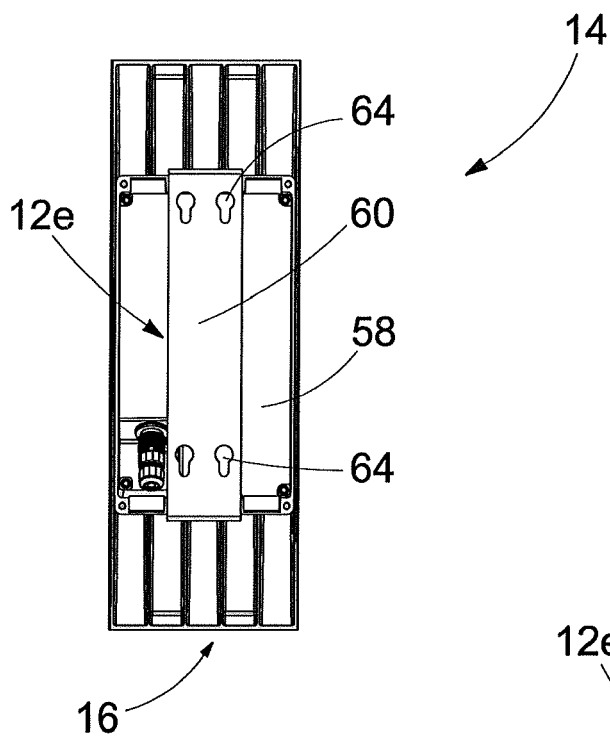


FIG. 24

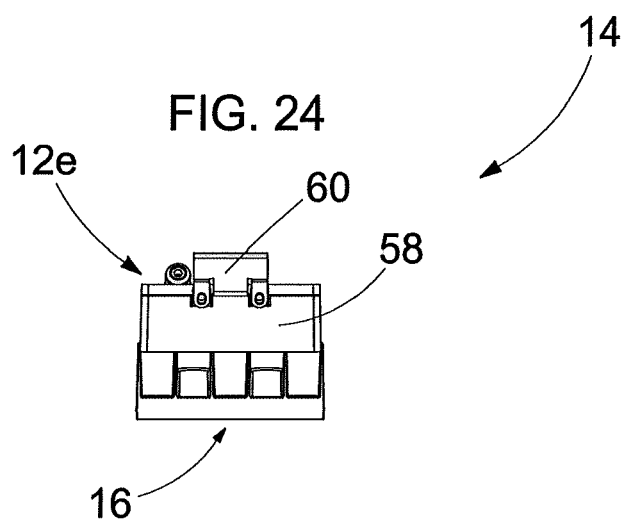
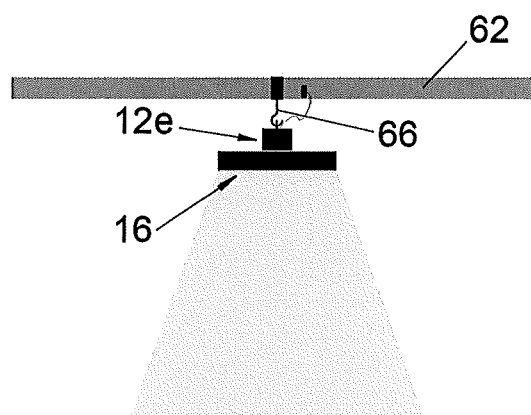


FIG. 25



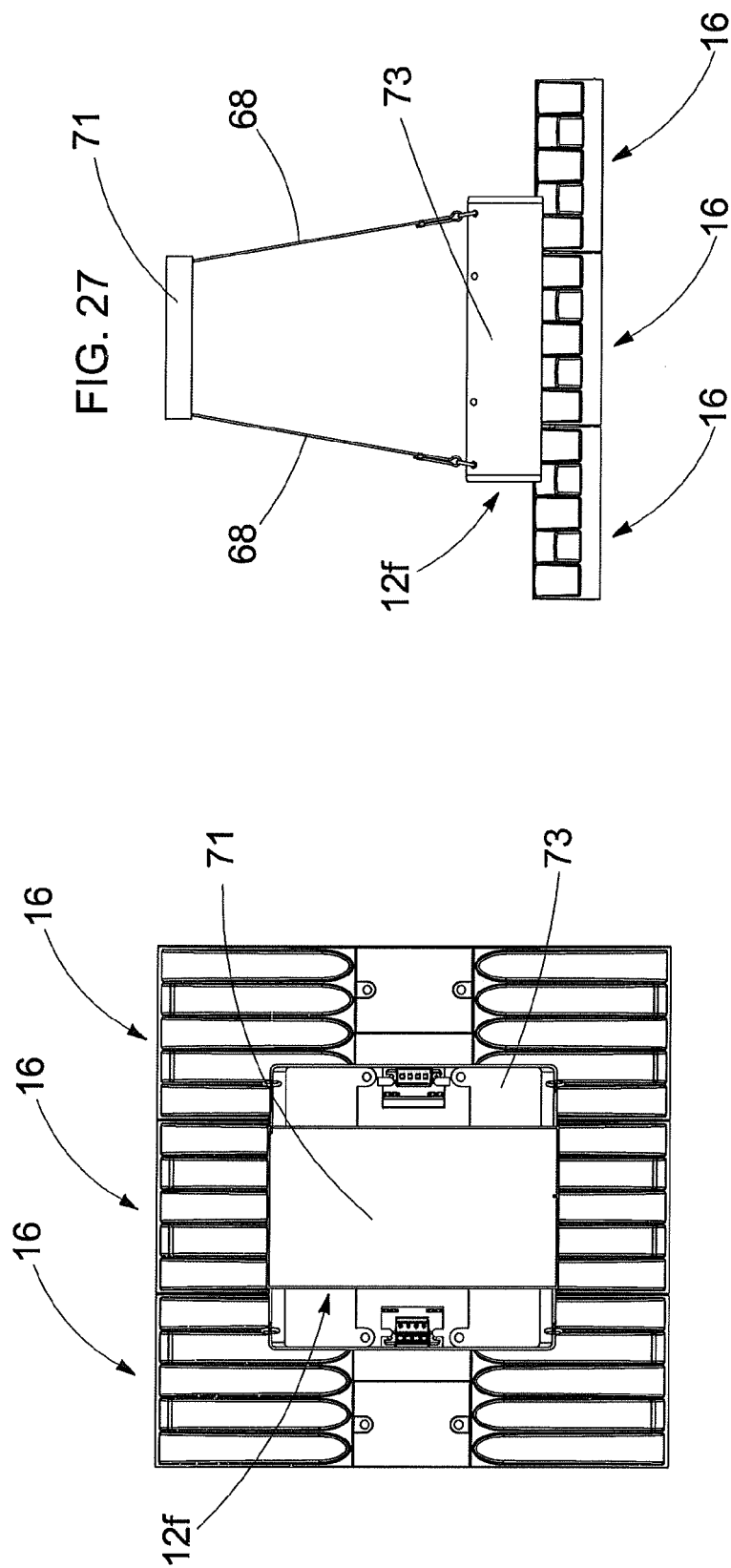


FIG. 26

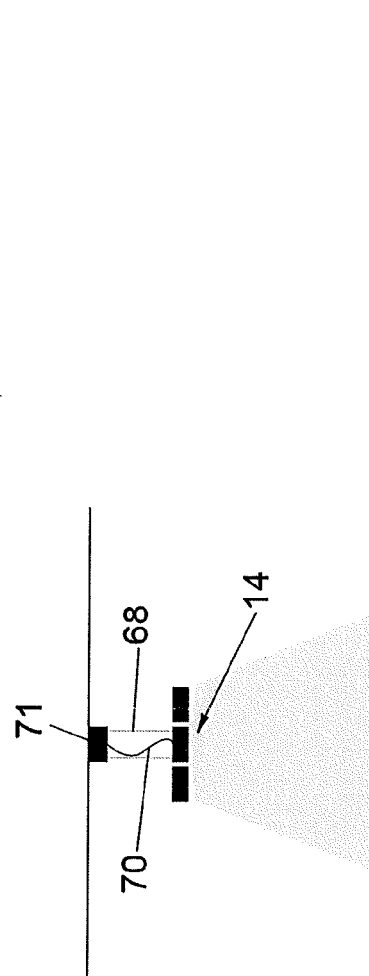


FIG. 28



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 Application Number
EP 14 19 3819

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