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(54) Lighting system

(57) Lighting device used to light one or more spaces (20), comprising a plurality of lighting bodies (24), each provided with at least a source of light (26) to light a predetermined zone (22) of the one or more spaces (20). The lighting device comprises a distribution element (16) of electric energy, associated with a predetermined seat delivering electric energy of an electric plant of the space (20). The distribution element (16) is suitable to distribute electric energy to each lighting body (24) by means of electric connections (18) exiting from the distribution element (16) toward each lighting body (24). The distribution element (16) comprises feed means (40) to feed independently at least a relative lighting body (24) in a desired functioning condition in order to light the corresponding zone (22).

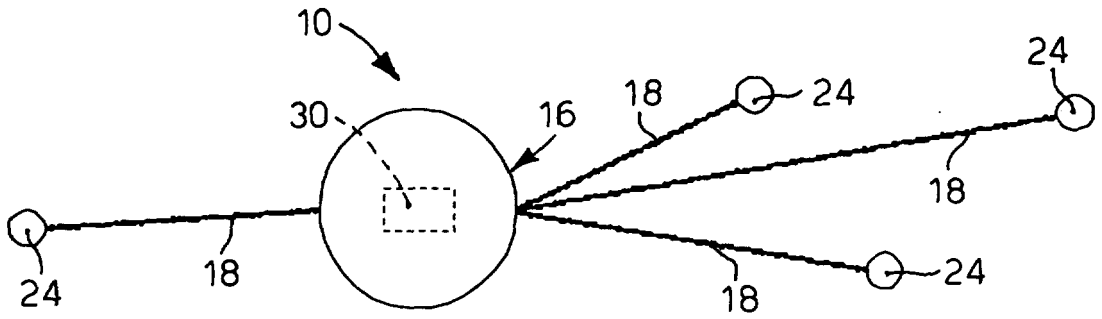

fig. 3

EP 2 241 804 A1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a lighting device used in domestic, industrial and commercial spaces such as offices, shops, restaurants, gyms or others.

[0002] The lighting device according to the present invention comprises a plurality of lighting bodies, preferably, but not only, of the LED type, monochromatic or with a chromatic variation.

BACKGROUND OF THE INVENTION

[0003] Lighting devices are known, comprising a plurality of lighting bodies, each of which is provided with a source of light such as for example a halogen lamp, an incandescent lamp or other. The known lighting device also comprises at least an element for the distribution of electric energy, advantageously associated with a light point, mounted for example on a wall or a ceiling in correspondence with a predetermined seating provided for the delivery of electric energy from an electric plant.

[0004] The distribution element is suitable to distribute electric energy to each of said lighting bodies by means of a predetermined electric connection which provides a plurality of cables, exiting substantially radially from the distribution element. Each electric cable is suitable to feed at least a predetermined lighting body.

[0005] The electric connection between the various lighting bodies is obtained substantially by means of a parallel connection between the cables made in correspondence with the distribution element, thus providing the switching on, the switching off and/or the simultaneous variation in light intensity of all the bodies of the known lighting device.

[0006] It is also provided that the electric connection is made by disposing each lighting body in a desired position, corresponding to a predetermined zone in the space to be lit, using the same electric cables as suspension members, assembling them in sight in a wall and/or a ceiling development and/or constraining them at predetermined suspension points. In this way it is possible to position the lighting bodies inside a space to be lit according to a desired disposition, allowing an effective lighting where it is actually desired and without making any modifications to the pre-existing electric plant.

[0007] One disadvantage of the known lighting device is that it is not possible to modify individually the intensity of the stream of light emitted by each individual lighting body.

[0008] Moreover, it is not possible to control with precision possible variations in the currents absorbed by the lighting bodies during functioning. This causes inefficient performances of the lighting bodies, such as for example a reduction or increase of the stream of light during long periods of functioning, with respect to a stream of light value set when the known lighting device is switched on.

[0009] One purpose of the present invention is to make a lighting device which allows to make individual modifications of the stream of light intensity emitted by each individual lighting body even when the corresponding sources of light are of the LED type.

[0010] Another purpose of the present invention is to make a lighting device which allows to maintain constant the intensity of the stream of light emitted by each individual lighting body even for long intervals of functioning.

[0011] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0012] The present invention is set forth and characterized in the independent claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0013] In accordance with the above purposes, a lighting device according to the present invention can be used to light one or more spaces. The lighting device comprises a plurality of lighting bodies, each provided with at least a source of light, and suitable to light a predetermined zone of said one or more spaces.

[0014] The lighting device also comprises an element for the distribution of electric energy, associated with a predetermined delivery seating of electric energy of the electric plant of the space to be lit. The distribution element is suitable to distribute electric energy to each of the lighting bodies by means of predetermined electric connections exiting from the distribution element toward each lighting body.

[0015] The electric connections are used, in one embodiment of the invention, as members to assemble the lighting bodies to walls and/or ceilings of said one or more spaces so that each lighting body connected to said distribution element is associated with a corresponding zone to be lit.

[0016] According to a characteristic feature of the present invention, the at least one distribution element has its own electric feed means, and at least a microprocessor electronic card. The electric feed means are suitable to feed said lighting bodies independently from each other, so that each of them can be activated in a desired functioning condition to light said relative zone, on the basis of the programming which can be carried out on the microprocessor card.

[0017] According to the present invention, the feed means are suitable to selectively adjust, independently from each other, the amount of electric energy which feeds each lighting body connected to said distribution element, and, therefore, the stream of light emitted by the associated sources of light.

[0018] According to another variant of the present invention, at least some of the sources of light are lamps of the LED type.

[0019] According to another variant of the present invention at least some of said LED lamps are of the RGB (Red, Green, Blue) and/or AWB (Amber, White, Blue) type.

[0020] Another variant of the present invention provides that the distribution element also comprises sensor means, operatively associated with the feed means and with the electronic microprocessor card, able to detect, directly or indirectly, at least some of the functioning electrical quantities of each lighting body so as to allow to regulate the corresponding electric feed energy and substantially to maintain the stream of light constant over time at a predetermined emission value corresponding to a set functioning condition.

[0021] According to another variant of the present invention, the lighting device comprises remote command means, such as one or more remote controls or radio controls suitable to selectively activate the feed means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- figs. 1A-1D are schematic drawings of lighting devices in different spaces;
- fig. 2 is a schematic lateral drawing of a lighting device according to the present invention;
- fig. 3 is a schematic view from below of the device in fig. 2;
- fig. 4 is a block diagram of a detail of the lighting device according to the present invention; and
- fig. 5 is a schematic view of the device in fig. 2.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0023] With reference to the attached drawings, a lighting device 10 according to the present invention can be used to light one or more spaces 20, for example in domestic or commercial spaces, in shops, restaurants, gyms or other, or in industrial contexts.

[0024] The lighting device 10 comprises (figs. 1A-1D, 2, 3 and 5) a distribution element, or plate, 16, a plurality of lighting bodies 24, each provided with one or more sources of light, in this case LED elements 26, and an electronic card 30 of the microprocessor type, for light management purposes, incorporated into the plate 16, and to which the lighting bodies 24 are indirectly connected. The device 10 also comprises a remote command device, in this case a remote control 52 in radiofrequency, suitable to cooperate with the electronic card 30 to command the switching on, switching off and/or the adjustment of the light intensity of each LED element 26 as will be described in more detail hereafter.

[0025] The LED element or elements 26 can be both monochromatic and with color variation, such as a LED unit with a set of three colors RGB or AWB.

[0026] The plate 16, circular in shape, comprises a box-like containment body inside of which the electronic card 30 is housed. The plate 16 is suitable to be mounted, in a known manner, on a wall or on the ceiling 12 of the space 20 to be lit, substantially in correspondence with a seating for the delivery of electric tension of the electric lighting circuit, that is, a seating in which a corresponding wall or ceiling light point is substantially provided.

[0027] The device 10 is normally fed at the alternating tension of the electric circuit and can be switched on or off by means of a corresponding group of switches and/or circuit breakers, not shown in the drawings, which are part of the lighting plant.

[0028] A plurality of electric cables 18 of the low tension type, suitable to feed each lighting body 24 electrically, exit from the plate 16 substantially radially and divergent from the plate 16. The cables 18 are also used as attachment members to attach the lighting bodies 24 to a wall and/or ceiling. In this case each cable 18 is laid and/or attached to the wall and/or ceiling and/or partially constrained at predetermined attachment points of the ceiling 12, by means of attachment pawls 28 or other.

[0029] In this way it is possible to position, in a desired way, each lighting body 24 inside the space 20 to be lit, in order to concentrate the relative stream of light onto a predetermined area 22, such as the surface of a table, or work top or other. This allows to distribute the lighting bodies 24 in an effective way with respect to a lighting system of the conventional type which uses lighting bodies substantially disposed in proximity to existing light points.

[0030] The electronic card 30 of the plate 16 (fig. 4) comprises a control and processing unit, in this case a microprocessor unit 32 of the known type, for example 8 or 16 bit, suitable to command the activation, by means of corresponding command ports 34, of a plurality of tension regulators 40, or power drivers. Each regulator 40 is in turn suitable, as will be explained hereafter, to directly feed, at a desired feeding tension, a corresponding lighting body 24. Advantageously, each tension regulator 40 is able to deliver to each lighting body 24, that is to the relative sources 26, a variable current, depending on the intensity of light desired, having a maximum value of about 800mA with an exit tension of about 24V.

[0031] The card 30 is also provided with a reference source 42 of direct tension, having a tension value suitable for the electric feed of the lighting bodies 24. The tension value is typically, for lighting elements with power LED, comprised in a range of about 24V.

[0032] The tension source 42 can be part of a unit for the transformation and rectification of the alternate feed tension of the electric power supply of a known type, such as a transformer connected to a tension rectification bridge, from which the feed tension of the microprocessor unit 32 can also be derived.

[0033] The feed source 42 is electrically connected to each of the tension regulators 40, in this case to a corresponding reference input (not shown), by means of a tension reference line 42a so as to supply to each regulator 40 a reference direct tension.

[0034] Each regulator 40 is electrically connected by means of a command line 34a to a command port 34 of the microprocessor card 30 and at exit, by means of a corresponding feed line 40a, to the associated lighting body 24 so as to feed it with tension and current with the desired value and intensity.

[0035] Advantageously the command ports 34 are independently commandable, for example according to a square wave pulse width modulation of the Pulse Width Modulation type (PWM), so as to drive each regulator 40 at a desired frequency, This allows to feed each LED element 26 with a predetermined feed current, substantially at the same frequency as the PWM output of the command port 34, so as to emit a corresponding stream of light of the desired intensity.

[0036] The electronic card 30 also comprises a circuit to detect the electric power and development of the electrical quantities, for example tension or current, actually absorbed by each lighting body 24, that is, of the associated LED element 26. In fact, the electrical quantities are picked up in correspondence with a pick up point P of the feed line 40a and passed through a corresponding conditioning circuit 44 in order to condition the corresponding physical levels to a value compatible with those of the microprocessor unit 32. The exit of each conditioning circuit 44 is connected, through a feedback line 44a, to a corresponding detection port 36 of the microprocessor unit 32, for example provided with a square wave input PWM detector.

[0037] In this way, the microprocessor unit 32, as will be described in more detail hereafter, is able to regulate, that is, to keep the electrical quantities feeding each lighting body 24 substantially constant over time. This in turn ensures the emission of a stream of light that is constant over time, based both on possible settings of a user and also according to possible variations in the LEDs 26, due for example to thermal drift or other, which can cause a reduction in the stream of light, light fluttering phenomena, or unwanted changes in the color temperature of the LEDs.

[0038] The plate 16 is also advantageously provided with a terminal board 29 (figs. 4 and 5) having connection terminals 29a, two for each lighting body 24, electrically connected to a corresponding feed line 40a and suitable for the stable attachment of a relative feed cable 18. The plate 16 is also provided with cable clips 19, disposed substantially equally spaced on the external edge of the plate 16 and suitable to stably clamp each cable 18 so as to prevent the terminals 29a from possibly coming out during the assembly of the device 10. This allows to easily connect each lighting body 24 to the corresponding feed line 40a during the assembly of the device 10.

[0039] The electronic card 30 is also provided with a radiofrequency interface 50 of a known type, electrically connected to a remote control port 38. The radiofrequency interface 50 is suitable to cooperate with the remote control 52 to receive different radiofrequency signals generated by the remote control 52 according to the specific key 52a that has been pushed. The radiofrequency signals are converted by the interface 50 into corresponding electric signals that are interpreted by the microprocessor unit 32 to activate the specific regulator 40.

[0040] Advantageously the frequency of communication of the radiofrequency signals, that is, the frequency of transmission of the remote control and reception of the interface 50, is around 488 MHz. It is understood that the device 10 can be provided with two or more remote controls 52 to allow the device 10 to be managed by several users.

[0041] The electronic card also comprises a multi switch 60, of the rotary dip switch type, directly connected in a known manner to one or more ports of the microprocessor unit 32, and suitable to be used to configure the device 10 dynamically, that is, to create a functional correspondence between each key 52a of the remote control 52 and a corresponding lighting body 24. In this way it is possible to univocally identify each lighting body 24, that is, a corresponding area 22, associating it substantially with one or more keys 52a.

[0042] The device as described heretofore functions as follows.

[0043] When a user presses a predetermined key 52a of the remote control 52, functionally corresponding to at least one predetermined lighting body 24, a specific radiofrequency signal is emitted, containing for example a predetermined identification code relating to the specific body 24, and a drive code, that is, a switch on or switch off code or, in the case of prolonged pressure on the key 52a, a code to vary the light intensity of the specific LED element 26.

[0044] The radiofrequency signal is received by the radiofrequency interface 50 and is subsequently communicated to the microprocessor unit 32. For example when switching on, the microprocessor unit 32 enables the corresponding tension regulator 40, piloting the associated command port 34 with a PWM signal having a square wave period that allows to deliver at output from the specific regulator 40 a predetermined electric feed current at a functioning tension that guarantees the emission of a desired stream of light intensity.

[0045] The microprocessor unit 32 also detects continuously, by means of the detection ports 36, the conditioning circuit 44 and the feedback line 44a, the development of the PWM signals delivered by the corresponding regulator 40. This allows to detect possible variations with respect to the PWM signal generated by the command port 34, that is, variations in the electric feed or dimming quantities of the lighting bodies and therefore indirectly of the light intensity of the specific LED elements 26.

[0046] In addition it is possible to detect possible var-

iations or disturbances of the feed tensions of the LED elements 26, due for example to variations in their temperature during a prolonged period of functioning.

[0047] Therefore the microprocessor unit is able to modify the PWM signals at inlet to the regulators 40 and hence feed each LED element 26 so as to obtain a desired stream of light intensity, substantially stable during functioning.

[0048] It is understood that the device 10 can provide to simultaneously switch on, switch off and/or continuously regulate the stream of light intensity of all the lighting bodies 24 controlled by the plate 16, by using specific dedicated keys 52a.

[0049] It also comes within the field of the present invention to provide that at least some of the lighting bodies 24 can be grouped together functionally so as to allow them to be switched on or off, or the stream of light intensity varied in a substantially simultaneous manner.

[0050] It also comes within the field of the present invention to provide that an auxiliary lighting body 27 is disposed directly on the plate 16. For example a lamp 27 (fig. 5) of the traditional type or halogen or LED can be mounted directly on the plate 16.

[0051] It also comes within the field of the present invention to provide that he device 10 is also provided with a conveyed waves communication interface that allows, for example, cooperation with an automation plant and thus allows to feed each lighting body 24 according to one or more predefined functioning scenarios.

[0052] It is clear that modifications and/or additions of parts may be made to the lighting device 10 as described heretofore, without departing from the field and scope of the present invention.

[0053] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of lighting device, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Lighting device used to light one or more spaces (20), comprising a plurality of lighting bodies (24), each associated with a zone (22) of said space (20), each lighting body (24) being provided with at least a source of light (26), the device comprising a distribution element (16) of electric energy, associated with a predetermined seat delivering electric energy of an electric plant of said space (20), and able to distribute electric energy to each of said lighting bodies (24) by means of electric connections (18) between said distribution element (16) and each lighting body (24), **characterized in that** said distribution element (16) of electric energy comprises electric feed means (40, 42) and a microprocessor electronic card (30), wherein said electric feed means comprise a reference source of direct tension (42) and a plurality of tension regulators (40), one for each lighting body (24) to be fed, connected to said source of direct tension (42), wherein said microprocessor electronic card (30) comprises a plurality of command ports (34), one for each lighting body (24), able to be independently modulated so as to drive each one of said tension regulators (40) at a desired frequency to regulate independently the stream of light emitted by each of said lighting bodies (24) and/or to keep constant over time the electric feed quantities of each of said lighting bodies (24).

2. Device as in claim 1, **characterized in that** the distribution element (16) comprises sensor means (36, 44), operatively associated with the relative feed means (40, 42), able to detect, directly or indirectly, at least some of the functioning electrical quantities of each lighting body (24) in order to regulate the corresponding electric feed energy for each of said lighting bodies (24).

3. Device as in claim 1, **characterized in that** at least some of the sources of light (26) are LED type lamps.

4. Device as in claim 3, **characterized in that** at least some of said LED type lamps are RGB and/or AWB type.

5. Device as in any claim hereinbefore, **characterized in that** it comprises remote command means (50) able to selectively activate said feed means (40).

6. Device as in claim 5, **characterized in that** the remote command means comprise at least a radiofrequency remote control (52).

7. Device as in claim 6, **characterized in that** it comprises configuration means (60) able to generate a functional correspondence between each key (52a) of the remote control (52) and at least an associated lighting body (24).

8. Device as in any claim hereinbefore, **characterized in that** it comprises at least a light body (27) mounted on said distribution element (16).

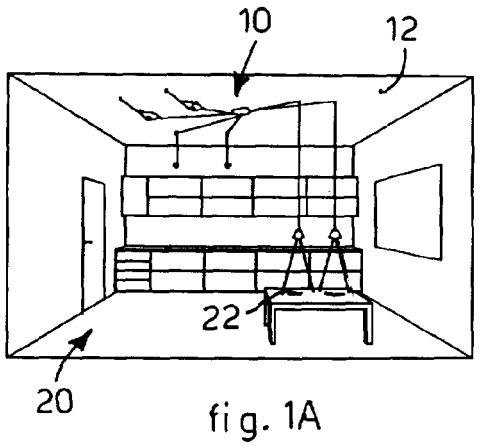

fig. 1A

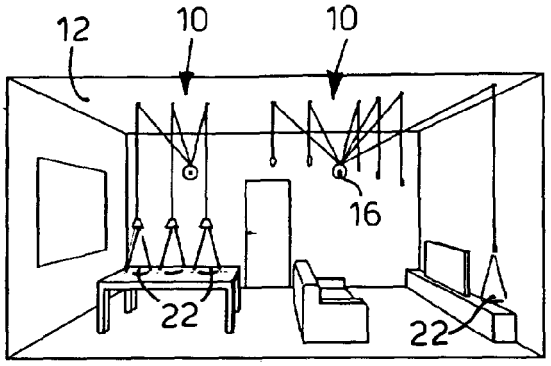

fig. 1B

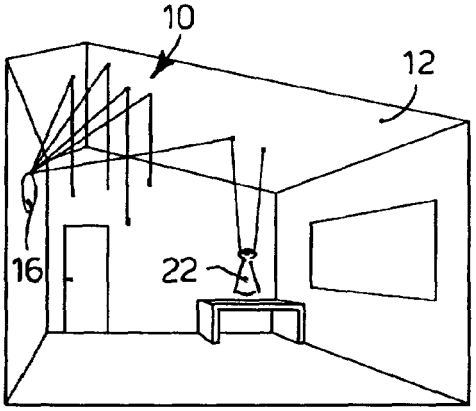

fig. 1C

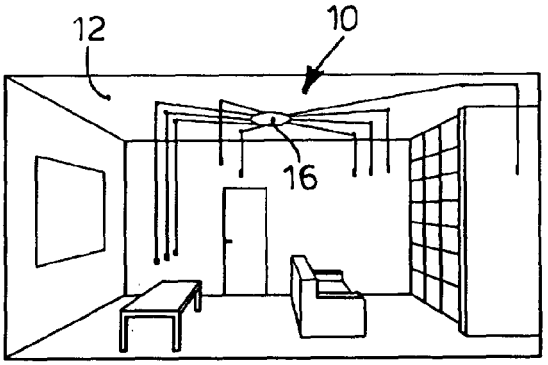

fig. 1D

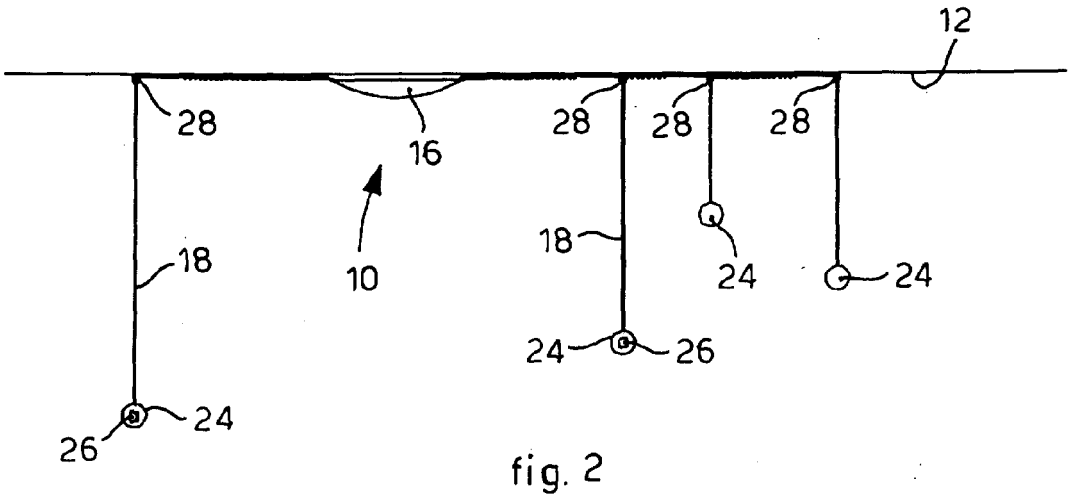

fig. 2

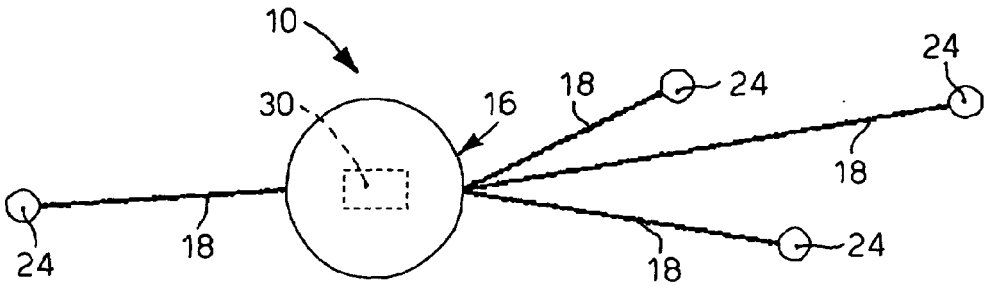
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fig. 3

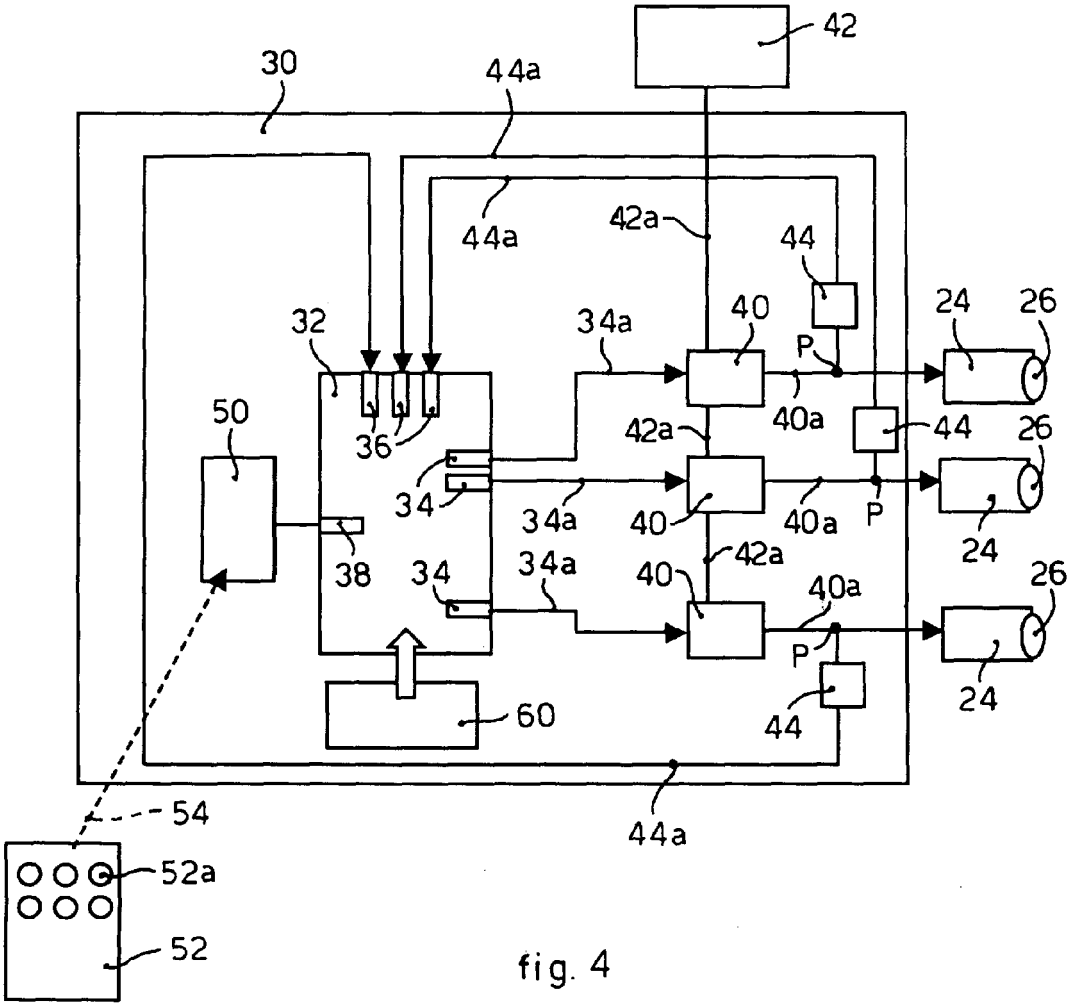
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fig. 4

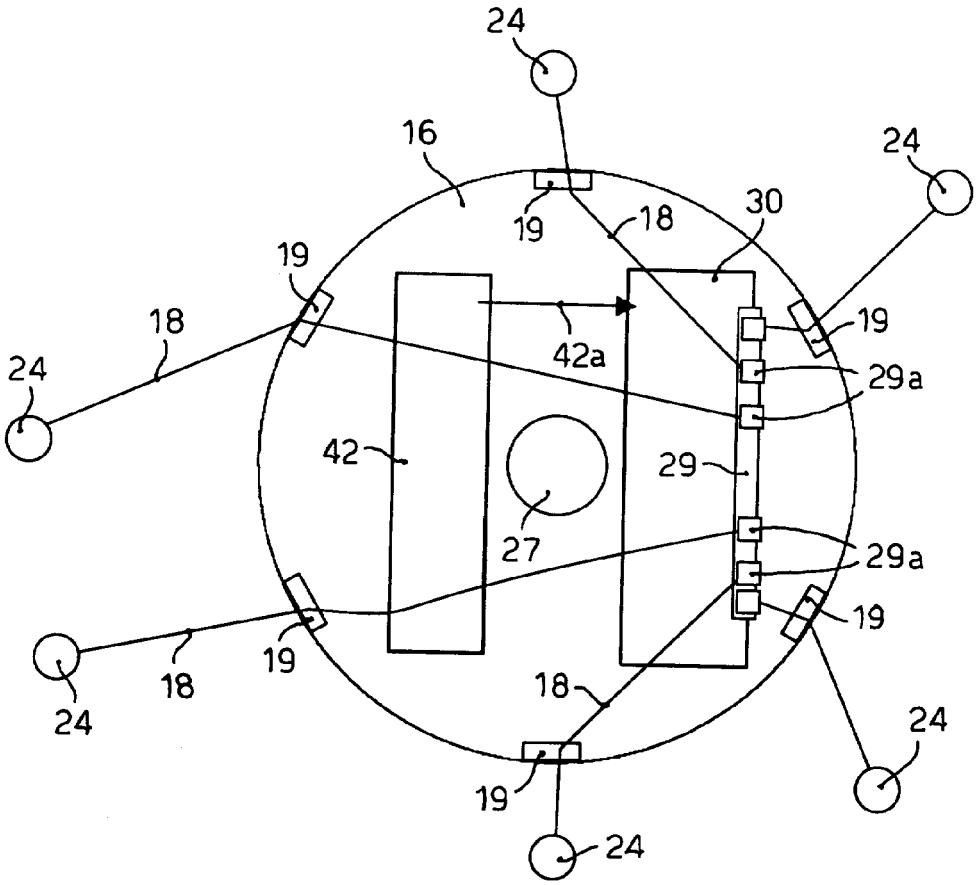
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fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 0093

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 2006/113927 A1 (BONDY MONTGOMERY C [CA] ET AL) 1 June 2006 (2006-06-01) * paragraphs [0002] - [0008], [0027] - [0033]; figures 1,2,7 * -----	1-8	INV. F21V23/04 F21S8/06 F21S2/00 F21V21/16 ADD. F21Y101/02
X	US 6 655 817 B2 (DEVLIN TOM [US] ET AL) 2 December 2003 (2003-12-02) * the whole document * * column 3, lines 15-36 * * column 4, lines 4-30 * -----	1,3-8	
X	WO 2009/021544 A1 (OSRAM GMBH [DE]; BOSNJAK ZORAN [DE]; CHROBAK-KANDO JEANINE [DE]; DELLI) 19 February 2009 (2009-02-19) * the whole document * -----	1-8	
X	EP 0 790 457 A2 (ARTEMIDE SPA [IT]) 20 August 1997 (1997-08-20) * the whole document * -----	1,3-6,8	

TECHNICAL FIELDS SEARCHED (IPC)

F21V
F21S
H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 August 2010	Chaloupy, Marc

CATEGORY OF CITED DOCUMENTS

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19-08-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006113927 A1	01-06-2006	NONE	
US 6655817 B2	02-12-2003	US 2003107888 A1	12-06-2003
WO 2009021544 A1	19-02-2009	CN 101779076 A	14-07-2010
		EP 2176584 A1	21-04-2010
EP 0790457 A2	20-08-1997	AT 240483 T	15-05-2003
		DE 69721861 D1	18-06-2003
		DE 69721861 T2	11-03-2004
		DK 790457 T3	08-09-2003
		ES 2199309 T3	16-02-2004
		IT MI960284 A1	14-08-1997
		JP 9231810 A	05-09-1997
		US 5961201 A	05-10-1999

EPO FORM P0459

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