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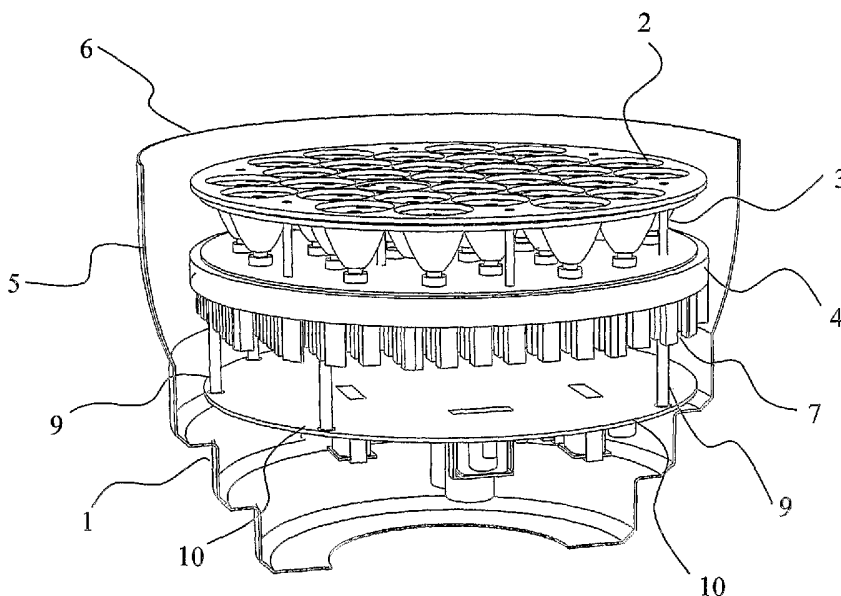
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(54) Title: LED LIGHT PROJECTOR



(57) Abstract: A light projector, of the type comprising: a light source (2) provided with a plurality of LED diodes (Light Emitting Diodes) (3); a structure (5) for housing said light source (2), having a terminal portion apt to allow the outlet of a light beam generated by said light source (2) from said light projector (1); means (13) being apt to control operation of said light source (2); means (12) for supplying said light source (2); characterized in that: said light source (2), said means (13) being apt to control operation of said light source (2) and said means for supplying (12) said light source (2) are integrated into said structure (5).



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LED LIGHT PROJECTOR

DESCRIPTION

The present invention relates to a light projector of the type comprising a light source provided with a plurality of LED diodes (Light Emitting Diodes), a structure with an open terminal portion arranged for allowing the outlet of the light beam generated by said light source from said light projector, means being apt to control operation of

5 said light source and means being apt to supply said light source.

According to the state of art, various light projectors of the type comprising a light source with a plurality of LED diodes (Light Emitting Diodes) are known, which have an electronic control circuit of the operation of the light source located in a remote position with respect to the light projector.

10 This solution is due to the fear that the heat produced by the light source may cause a wrong operation in the electronic control circuit. Therefore, the problem arising most frequently following such a remote location of said electronic circuits is caused by the need of providing a connection system consisting of a set of cables, which - along with the electric line - cause a more complex and expensive manufacture of the

15 system, which consists of the light projector and relevant control means of its operation.

Such a manufacture, in fact, requires on one hand the cables for carrying the electric current to operate the devices; on the other hand, it will also need other and further cables for ensuring the exchange of the information required by the electronic circuits

20 to control operation of the light projector and, therefore, to manage its various functions.

This plurality of cables is often subject to the effects of weathering agents, which may lead to their deterioration (considering that in general the insulating sheath of these cables has not a big section), and consequent interferences to the information

25 exchange between the light projector and the control system.

In addition, the external connecting cables extending between the light source and the circuit for its operation control may require the use of screened cables having a high cost and low flexibility during assembly or, in the instance of unscreened cables, the risk that they may function as detecting elements of external troubles, which will

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interfere with the reliability of the control system of the projectors operation.

Moreover, in many cases, the existence of external cables (besides the supply cables) would make installation more complicated should it be necessary to materially bring the cables to places having a difficult access (since the cables may be located in dangerous places for the technical operators to get access to, such as on high buildings and/or in bad maintenance conditions); also, it would not produce an appreciable esthetical result (thinking of the lighting of interiors).

According to the known art, various illumination systems are also known, which utilize LED diodes of different coloration for their light source. In particular, according to a common technique, the three primary colours most commonly used, i.e. red, blue and green, can be combined between them to provide a plurality of colours according to their mixing.

However, these systems have considerable drawbacks, since the colour corrections they provide are not constant ones and it is not possible to obtain small changes to the above corrections.

A further problem that may frequently occur in the use of the above illumination systems utilizing LED diodes, above all for the devices carrying a large number of luminous diodes, is due to an overheating of the components located inside the illumination systems. This problem makes integration of electronic components practically impossible, as adequate cooling is required inside the structure of the light projectors.

In this frame, it is the main object of the present invention to provide a light projector incorporating the electronic components of the projector inside its own structure.

A further object of the present invention is to provide a light projector, which can make correct use of the information required for its operation and performance of its various functions.

A further object of the present invention is to provide a light projector, which can obtain a light beam with different simultaneous colorations, continuously changeable.

A further object of the present invention is also to provide a light projector manufactured with materials such to avoid overheating of the inner components of said lighting devices.

In order to achieve such aims, it is the object of the present invention to provide a

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light projector incorporating the features of the annexed claims, which form an integral part of the present description.

Further objects and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 shows schematically a light projector incorporating the features of the present invention;
- Fig. 2 shows a side view of the inner components of a light projector incorporating the features of the present invention;
- Fig. 3 shows a plan view of a plate carrying the electronic circuits of a light projector incorporating the features of the present invention.

Referring now to the description of the drawings, Figure 1 represents a light projector (1), which comprises a structure (5) and a light source (2) consisting of a plurality of LED diodes (3).

The light produced by said plurality of LED diodes (3) generates a light beam with a constant or diverging section, flowing out from the light projector (1) through an open terminal section (6) of the structure (5) of said light projector (1). The form of the light beam section depends on the geometric arrangement of the LED diodes (3), on the form of the reflector surrounding the LED diodes (3) and on the lens located in line with said open end section (6) of the structure (5) of said light projector (1).

In a preferred embodiment of the present invention, the reflector surrounding each one of the LED diodes (3) consists of a collimator not shown in the figures, which concentrates the light emitted by each single LED diode (3) so as to obtain a substantially parallel light beam; then, the form of the section of said substantially parallel light beam can be changed using different lens placed in line with the open terminal section (6), such as flat lens, convex lens, "frosted" lens, etc., thus adapting the light beam to any desired use of the light projector (1) itself.

According to the present invention, preferably, this plurality of LED diodes (3) consists of Red, Blue and Green coloured LED diodes (3), so as to obtain all various colour shades by adding LED diodes (3) of a different basic colour, preferably Amber.

Through this feature of the present invention, these basic colours of the LED diodes (3) can be combined in different ways and generate the whole range of colorations

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detectable by the human eye, as well as the possibility provided by the Amber coloured LED diodes (3) of further changing (in the sense of correcting) this range of colorations emitted by the light projector (1) object of the present invention.

5 A further feature obtained through a combination of the above three primary colours adding said Amber coloured LED diodes (3), is one or more change corrections of the colour temperature, i.e. lowering determined colour temperature values before the resulting light beam flows out from said open end section (6) of the structure (5) of said light projector (1).

10 Thus, light beams with a different colour temperature suitable for different use conditions can be obtained, such as illumination of exteriors, illumination of interiors, and so on.

According to the present invention, the light projector (1) comprises at least a surface (4) ensuring the exact location of said plurality of LED diodes (3) and both the electric connection (for supply) and electronic connection (for control) of each single LED diode (3).

15 As illustrated more in detail in Figure 2 representing a side view of the light projector (1), the lower side of the surface (4) consists of a heat dissipator (7), realized in such a way to present a row of blades (8). Further rows of blades (8), not shown in Figure 2, are arranged concentrically and radially spaced from each other to provide an air passage; these rows of blades (8) are in thermal contact with the plurality of LED diodes (3) for the heat produced by said plurality of LED diodes (3) to be dissipated outside through their surface, thus avoiding that the heat may increment the temperature inside the structure (5) up to values such to cause damages to the inner components of the light projector (1).

25 A plurality of spacers (9) connect a plate (10) to the dissipator (7); this plate (10), being located at a certain distance from the dissipator (7), allows a free air flow between the plate itself and the dissipator (7), so as to ensure a cooling of the devices located inside the body of the light projector (1).

30 As it can be noticed in Figure 3, which represents a bottom view of the plate (10), all electronic components required for proper operation of the light projector (1) are located on said plate (10) and inserted from the side opposite to the one on which the LED diodes (3) are located; thus, the plate (10) carrying an electronic card (11) can operate like a thermal shield to the heat generated by the plurality of LED diodes (3).

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Therefore, as it can be noticed, the above arrangements make it possible to integrate the electronic control circuits inside the structure (5) of the light projector (1).

In particular, on the lower surface of said plate (10) is positioned an electronic card (11), which comprises a plurality of feeders (12), and a microprocessor (13) controlling the current supplied by said plurality of feeders (12) to the single LED diodes (3).

In a preferred embodiment of the present invention, each feeder (12) supplies a plurality of LED diodes (3) of the same colour.

The plate (10) also contains other conventional components, such as capacitors, resistors and coils.

In a further preferred embodiment, said feeders (12) are "cold" operating switching feeders, i.e. they dissipate little regulation current; this will optimise network consumption, since none of the card components (11) has significant leakages for the operating purpose. The LED diodes (3) are current controlled by the switching feeders (12), in order to regulate the luminosity through modulation of the outlet current of said feeders.

It is also possible to provide an amplitude current peak equal to about 30% of the value of the current capacity of the switching feeder (12) for a 30% duty cycle, thus improving the brilliancy of the LED diodes (3).

The microprocessor (13), which may be a common Flash type, controls the current generated by the feeders (12), so as to change the features of the light beam produced by the LED diodes (3); such as for the control of both the intensity, coloration and colour temperature of the light beam produced, and for controlling the functions causing special effects known as Strobo, Syncro and Delay.

In its preferred embodiment, the microprocessor (13) uses the PWM (Pulse-Width Modulation) technique for controlling the outlet current of the feeders (12). In addition, this microprocessor (13) can receive signals, such as through DMX (Digital Multiplex Protocol) or DALI (Digital Addressable Lighting Interface) communication protocols.

A further feature of the above microprocessor (13) is provided by its local or factory programming, whereby the microprocessor (13) contained inside the light projector (1) can cause the light projector (1) to execute determined "shows" and manage a plurality of light projectors connected to it. The microprocessor (13) contained inside

the light projector (1) may also operate as a "master" for controlling one or more "slave" light projectors fitted with a microprocessor for information exchange. Communication between the various microprocessors may also occur according to any procedure known at the state of the art, such as with wireless systems or through
5 a copper or optical fibre wiring, etc.

Given such a situation, therefore, each "slave" light projector is able to use the information received from the "master" light projector and activate its own functions (such as the ignition and intensity setting of the light supplied by the LED diodes (3), intensity and coloration control of the light beam, control and change of the colour
10 temperature of the light beam, execution of a determined show by the light projector (1), etc.).

From the above description the advantages of the present description are clear.

In particular, integration of the electronic components inside the structure (5) of the light projector (1), including the microprocessor (13) and feeders (12), ensures
15 manufacture of synchronized combinations of light projectors, without the need of a remote control station for controlling the single light projectors. Removal of said remote control station will drastically reduce the wiring necessary for connecting all the light projectors, with a consequent cost reduction, shorter manufacturing times for the system and a reduction of possible troubles.

Another advantage of the present invention is represented by the light beams with different colour shades, which can be generated by the light projector due to colour diversification and independent ignition of the various LED diodes (3) forming the light source.

Moreover, on one hand, the simultaneous use of LED diodes with a different basic
25 coloration (such as Amber colour) from the LED diodes of the three primary colours (Red, Blue and Green) simplifies calibration of the final colour desired; on the other hand, it will obtain light beams with a colour temperature differing from the one generated by the above LED diodes of the three primary colours, making the projector suitable for different utilizations.

Another advantage of the present invention is represented by the adequate
30 dissipation of the heat produced by the light source through a correct location and shielding of the inner components of the light projector, thus removing the overheating problems of the electronic components, which are also housed inside the

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same structure.

It can be easily noticed how the present invention is not restricted to the light projector described above in its various components, but it can be subject to many changes, improvements, replacement of components and equivalent elements, without departing from the inventive idea, as better detailed in the following claims.

5 One of its many possible changes consists in fitting the projector with an automatic device for determining the colour temperature generated by it. In this case the projector may be fitted with a closed loop control system of the colour temperature, in which a colour temperature sensor determines the temperature of the light beam
10 outlet from the projector and compares it with a predetermined value; should the result be divergent it would operate an electronic system for lowering or increasing said colour temperature to produce a light beam with the desired colour temperature.

CLAIMS

1. Light Projector of the type comprising:

- a light source (2) provided with a plurality of LED diodes (Light Emitting Diodes) (3);

5 - a structure (5) for housing said light source (2), having a terminal section such to allow the outlet of a light beam generated by said light source (2) from said light projector (1);

- means (13) being apt to control operation of said light source (2);

- means (12) for supplying said light source (2);

characterized in that:

10 said light source (2), said means (13) being apt to control operation of said light source (2) and said means for supplying (12) said light source (2) are integrated into said structure (5).

2. Light projector (1) according to claim 1, characterized in that said means (13) being apt to control operation of said light source (2) comprise a microprocessor.

15 3. Light projector (1) according to claim 2, characterized in that said microprocessor (13) is of the type known as Flash.

4. Light projector (1) according to claim 2, characterized in that said microprocessor (13) controls the current generated by said supplying means (12), in such a way to change the features of the light beam produced by the LED diodes (3).

20 5. Light projector (1) according to claim 2, characterized in that said microprocessor (13) uses a PWM (Pulse-Width Modulation) technique for controlling the outlet current of said supplying means (12) to said plurality of LED diodes (3).

6. Light projector (1) according to claim 2, characterized in that said microprocessor (13) is able to receive and/or transmit signals of the DMX or DALI type.

25 7. Light projector (1) according to claim 2, characterized in that said microprocessor (13) is able to manage a plurality of light projectors.

8. Light projector (1) according to claim 2, characterized in that said microprocessor (13) is locally and/or factory programmable.

30 9. Light projector (1) according to claim 2, characterized in that said microprocessor (13) ensures control of the functions causing special effects, in particular effects of the Strobo, Syncro and Delay type.

10. Light projector (1) according to claim 1, characterized in that said supplying

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means (12) of said light source (2) comprise at least a different feeder for each type of primary coloration of the LED diodes (3).

11. Light projector (1) according to claim 1, characterized in that said supplying means (12) comprise feeders (12) of the switching type.

5 12. Light projector (1) according to claim 10, characterized in that said switching feeders (12) supply a variable current to the LED diodes (3) controlled by said microprocessor (13).

13. Light Projector of the type comprising:

- a light source (2) comprising a plurality of LED diodes (Light Emitting Diodes) (3);
- 10 - a structure (5) for housing said light source (2), having a terminal section such to allow the outlet of a light beam generated by said light source (2) from said light projector (1);
- means (13) being apt to control operation of said light source (2);
- means (12) for supplying said light source (2);

15 characterized in that

said plurality of LED (Light Emitting Diodes) diodes (3) consists of Red, Green and Blue coloured LED diodes (3) to which LED diodes (3) of different basic coloration are added.

14. Light projector (1) according to claim 13, characterized in that said LED diodes (3)
20 of different basic coloration are Amber coloured LED diodes (3).

15. Light Projector, of the type comprising:

- a light source (2) comprising a plurality of LED diodes (Light Emitting Diodes) (3);
- a structure (5) for housing said light source (2), having a terminal section such to allow the outlet of a light beam generated by said light source (2) from said light
25 projector (1);
- means (13) being apt to control operation of said light source (2);
- means (12), for supplying said light source (2);

characterized in that

it provides means (7, 8) being apt to dissipate the heat produced by said plurality of
30 LED diodes (3).

16. Light projector (1) according to claim 15, characterized in that said means (7, 8) being apt to dissipate the heat produced by said plurality of LED diodes (3) comprise a dissipator (7).

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17. A light projector (1) according to claim 15, characterized in that said means (7, 8) being apt to dissipate the heat produced by said plurality of LED diodes (3) comprise a row of blades (8).

18. Light projector (1) according to claim 17, characterized in that said means (7, 8) being apt to dissipate the heat produced by said plurality of LED diodes (3) comprise a plurality of said row of blades (8), which are arranged concentrically and radially spaced from each other.

19. Light projector (1) according to claim 15, characterized in that said means (13) being apt to control operation of said light source (2) and said supplying means (12) supplying said light source (2) are assembled in such a way so as to be shielded through the support carrying them with respect to the heat produced by said plurality of LED diodes (3).

20. Light projector according to one or more of the previous claims, characterized in that said projector (1) has an automatic closed loop control circuit for determining the heat temperature of the light beam, in particular including a sensor of the colour temperature of the light beam generated.

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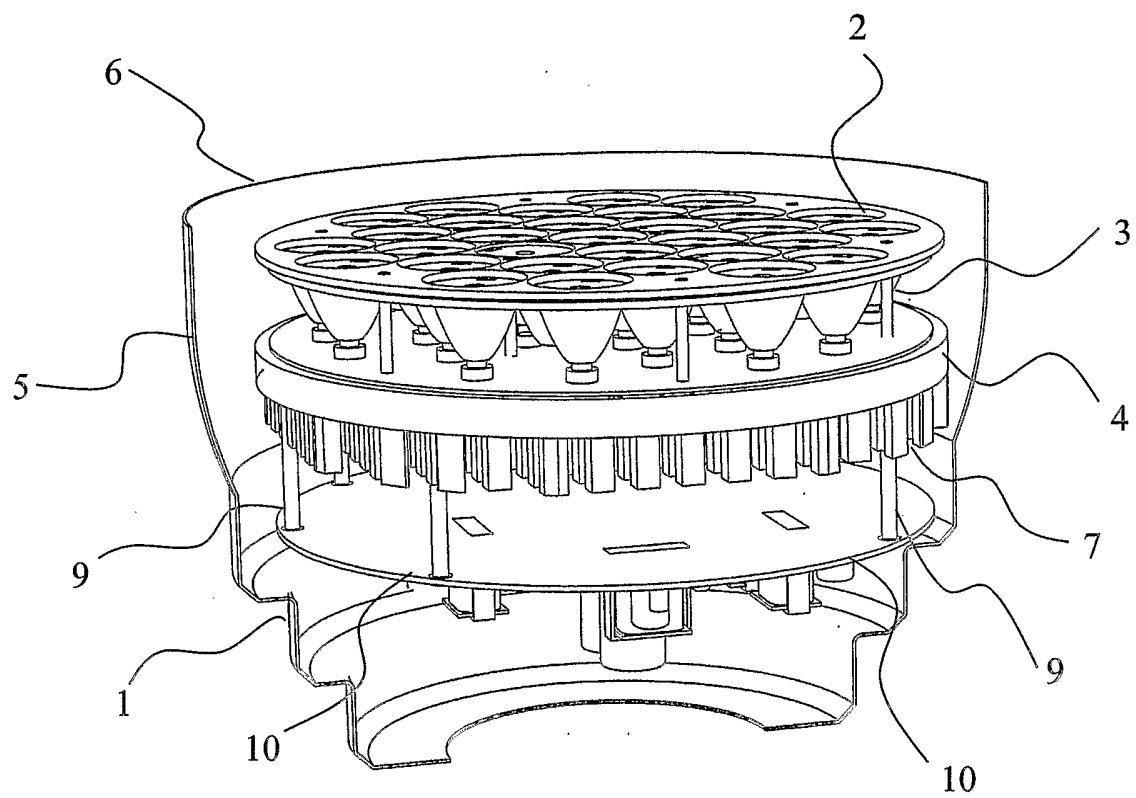


Fig. 1

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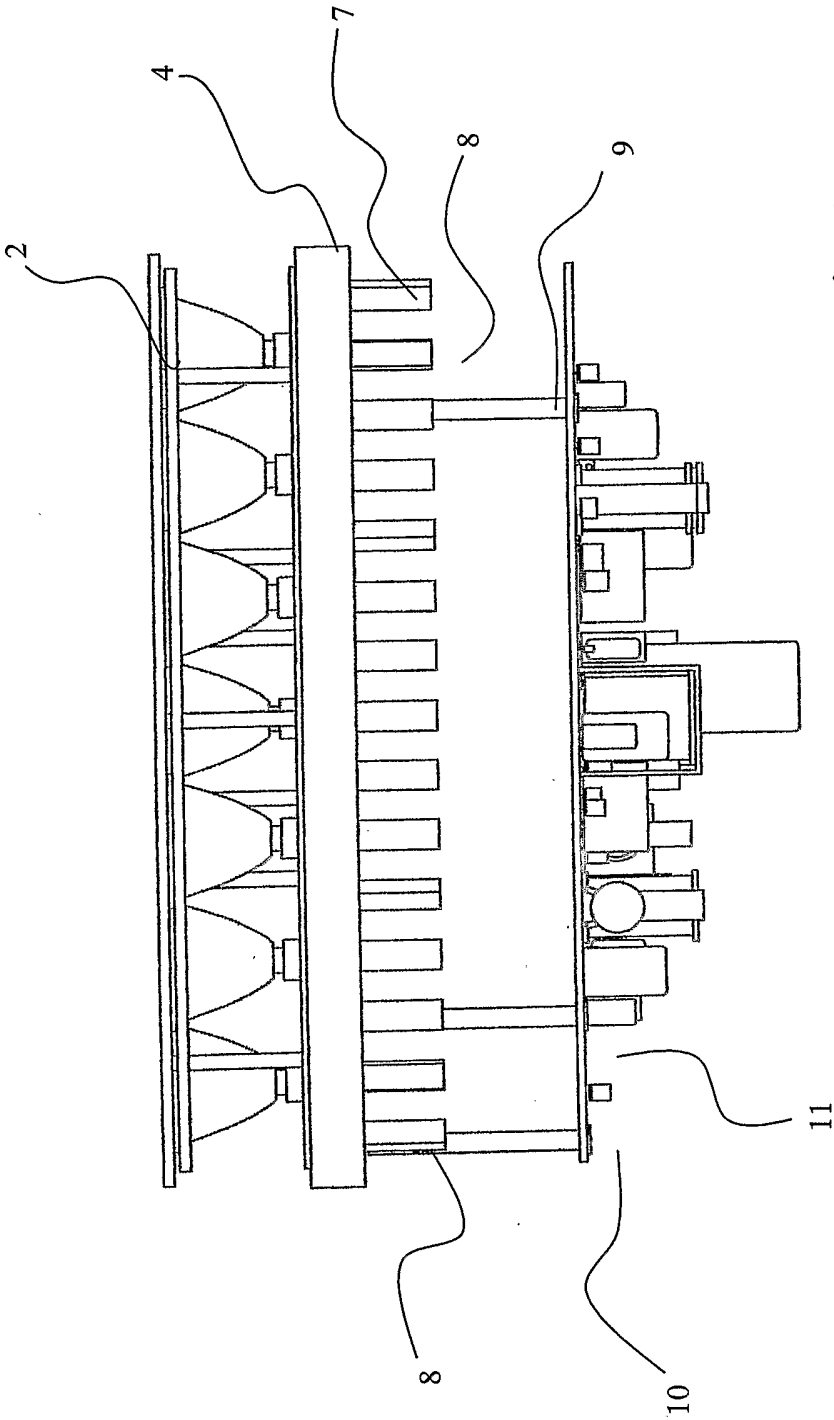


Fig. 2

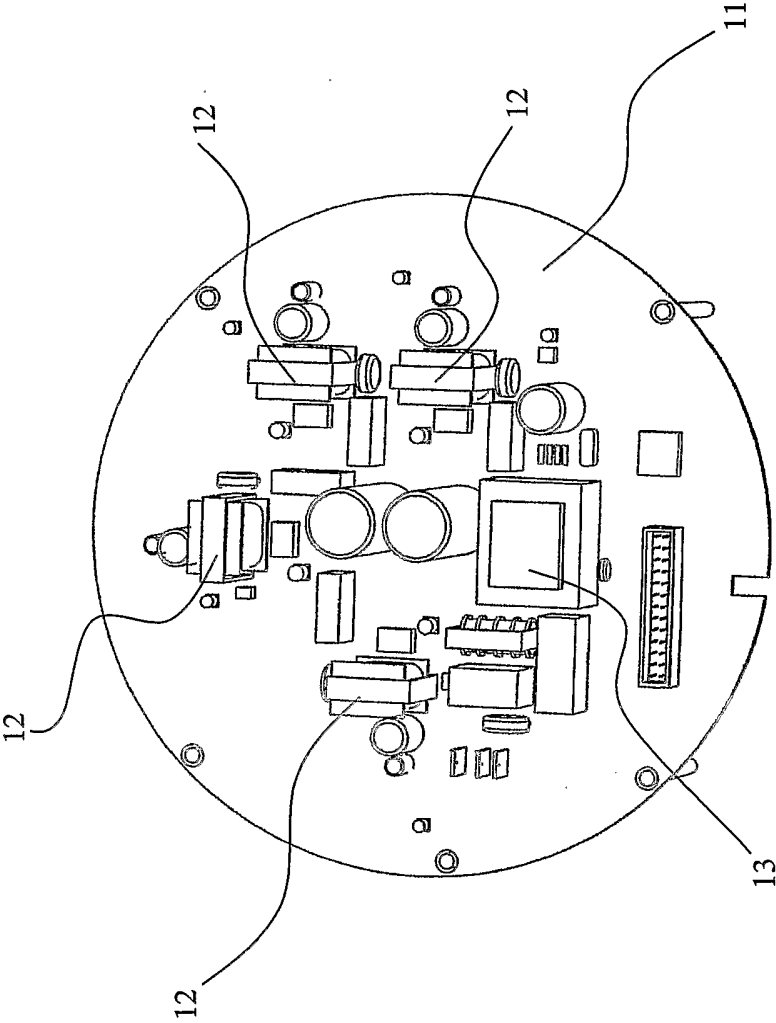


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F21S8/00 H05B33/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F21S H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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- *P* document published prior to the international filing date but later than the priority date claimed

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- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2004/000604

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 6 459 919 B1 (MORGAN FREDERICK MARSHALL ET AL) 1 October 2002 (2002-10-01)</p> <p>column 6, line 29 - line 35 column 6, line 55 - line 58 column 11, line 40 - line 67 column 12, line 55 - line 58 column 14, line 10 - line 29 column 15, line 18 - line 35 column 16, line 33 - line 48 column 17, line 44 - line 58 column 31, line 41 - column 32, line 18 column 40, line 59 - line 65 column 42, line 15 - line 38 column 44, line 18 - line 48 column 47, line 51 - column 48, line 9 column 48, line 28 - line 31 figures 7,9-11,19-21,23,71,72,75,76,83</p>	<p>1,2, 4-15,19, 20</p>
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INTERNATIONAL SEARCH REPORT

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Information on patent family members

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