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(54) Title: A LED DISPLAY SYSTEM

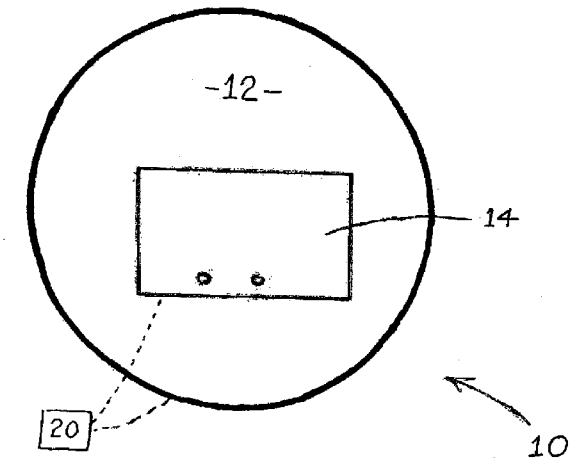


FIG 1

(57) Abstract: The present invention relates to a LED display system (10) including a panel (12) and detecting means (20). The LED display system (10) also includes means (14) for selectively varying power supply to the panel (12). The panel (12) has an array of LEDs. The detecting means (20) is adapted to activate or deactivate one or more of the LEDs.

A LED Display System

Technical Field

This invention relates to a LED display system, particularly but not exclusively, for installation in one or more traffic light lanterns.

Background of the Invention

The majority of traffic light lanterns currently in use are fitted with a quartz halogen light bulb, or even less efficient incandescent light globes with associated reflector and lens. As traffic lights are required to be in continuous operation all the time and the average life span of a halogen globe is limited to approximately 5000 hours, a regimen of continuous bulb replacement has to be implemented.

Although the housing of a traffic lantern housing is very robust with an average life expectancy of twenty years, the quartz halogen aspect contained within the housing is fairly high maintenance as it is not fully sealed and hence the reflector and lens surface need to be cleaned at regular intervals. Also, the fine element within the bulb is very easy to break when it is bumped. Therefore there has been an attempt to replace the quartz halogen light bulbs with light emitting diodes (LEDs) which have a solid-state light source.

For the above reasons, quartz halogen traffic lights in most if not all countries around the world are being replaced with LEDs. At present, the only way to achieve this is by replacing each lantern in its entirety, not just the globe contained therein. This typically involves dismantling everything from a pole to enable installation of the replacement and unavoidably causes inconvenience due to the need to take one or more of the following measures: switching off an entire set of lights at a relevant intersection, allocating traffic wardens to direct traffic; employing heavy duty lifting equipment and blocking off affected traffic lanes.

Also, quartz halogen lantern housings have a life expectancy of twenty years and are

generally in good condition when they are replaced. Discarding these lantern housings is a gross waste of resources, let alone being poor ecological practice.

Despite the above, existing LEDs used to replace quartz halogen lights have their own problems too in that they are susceptible to failure due to overheating, particularly during summer.

It is an object of the present invention to provide a LED display system which may overcome or ameliorate the above problems or which will at least provide a useful alternative.

Disclosure of the Invention

According to one aspect of the present invention, there is provided a LED display system including:
a panel having an array of LEDs;
means for selectively varying power supply to the panel; and
detecting means adapted to activate or deactivate one or more of the LEDs.

In a preferred embodiment, the panel is a printed circuit board on which the LEDs are mounted.

The power varying means may include one or more driver circuits adapted to be controlled by or incorporated in a microprocessor. The power varying means may be adapted to operate on a constant current. The power varying means is preferred to be adapted to empower one or more panels of different sizes.

Each driver circuit is preferred to be capable of varying the brightness of the LEDs at a predetermined time or for a predetermined period of time as desired. For instance, the driver circuit may be capable of gradually dimming the LEDs in accordance with a stepped profile. Preferably, if one or more of the LEDs have failed, the driver circuit may be capable of maintaining the remainder of the LEDs activated at a desired level of brightness. More preferably, when more than a predetermined percentage of the LEDs

have failed, the driver circuit is adapted to deactivate the remainder of the LEDs. Even more preferably, the predetermined percentage is 20%.

The driver circuit may be adapted to cause flashing of the LEDs for variable lengths of time.

In a preferred embodiment, the detecting means may be in communication with the microprocessor. The detecting means may include or be connected to a push button which when activated is adapted to cause flashing of the LEDs for a predetermined period of time. Optionally, the detecting means includes one or more of the following: a heat detecting device; a motion detecting device or sound detecting device. For instance, the motion detecting device may include a trip wire which when triggered is adapted to activate an electronic display board for road users.

The microprocessor may be programmed to enable various parameters to be set and changed for activation and deactivation of the driver circuit.

The microprocessor may be programmed to operate multiple colour LEDs by controlling more than one driver circuit. Each driver circuit is preferred to be responsible for the operation of the LEDs on a selected panel.

The LED display system is preferred to be powered by an AC or DC power source. Preferably, the power source is a printed circuit board (PCB) heat sinked LED driver. Optionally, the LED display system includes an additional drive circuit adapted to control a larger or an additional LED panel.

Optionally, the printed circuit board includes a dual in-line package (DIP) switch adapted to customise the behaviour of the LED for specific situations or to control additional software functions.

Brief Description of the Drawings

The invention may be better understood from the following non-limiting description of a preferred embodiment, in which:

Figure 1 is a schematic plan view of an underside of a LED display system in accordance with the present invention;

Figure 2 is a circuit diagram illustrating the driver circuits and microprocessor of the LED display system of Figure 1; and

Figure 3 is a diagram being a simplified version of Figure 2.

Detailed Description of the Drawings

Referring to Figure 1, a LED display system 10 includes a panel 12 having an array of LEDs (located on the other side of the panel 12 and hence not visible) and means for selectively varying power supply to the panel 12. In this embodiment, the panel 12 is a printed circuit board on which the array of LEDs are mounted.

Turning to Figures 2 and 3, the power varying means includes driver circuits incorporated in a microprocessor. The microprocessor is in the form of a controller card 14 which is electronically connected to the panel 12 (refer to Figure 1). The controller card 14 operates on a constant current and is capable of empowering panels of different sizes. In the present embodiment, each panel is connected to and driven by one controller card 14. The controller card 14 is screwed onto the panel 12 via metal spacers. This arrangement both secures and powers the LED panel 12 yet keeps the number of physical parts to the minimum.

The controller card 14 includes a microchip 16 with a driver circuit capable of performing various primary functions. The driver circuit is capable of supplying power to panels of two different sizes, namely 200mm and 300mm in diameter. The power output is increased for a larger sized panel.

The LED display system of the present invention also includes a detecting means for activating or deactivating the LEDs. In the present embodiment, the detecting means is in the form of a push button (not shown) which is in communication with the microprocessor. When activated by a pedestrian, the push button sends a signal to the

driver circuit which causes flashing of the LEDs for a predetermined period of time. It is contemplated that in place of or addition to the push button, the detecting means may include one or more of the following: a heat detecting device; a motion detecting device or sound detecting device. For instance, a motion detecting device may include a trip wire using trigger input 20 which is located at a certain distance from a set of traffic lights. With such an arrangement, a vehicle approaching the set of traffic lights will trigger the trip wire which will send an electronic signal to the driver circuit which will in turn activate an electronic display board provided to generate a visual signal for the driver of the vehicle. The visual signal may be a speed limit or a warning sign indicating the occurrence of an accident ahead.

The microprocessor includes a programmable trigger input 20. The input 20 is to be generated by an external trigger such as the push button described above and is programmed to send an electronic signal to the microchip 16 for activating or adjusting the brightness of the LEDs.

The microprocessor is also capable of controlling the driver circuit to cause flashing of the LEDs for variable lengths of time. This is beneficial in that it is usually desirable for wide and long roads to have signs capable of flashing for a longer period of time to render the signs more noticeable to road users.

The LED display system 10 is powered by a power source 18 capable of generating either of alternative and direct current (AC or DC) as desired. The power source 18 is a printed circuit board (PCB) being heat sink cooled to be efficient in dissipating and dispersing heat to reduce the likelihood of overheating of the LEDs. The LED display system 10 can be empowered with either a 5-28V AC or 12V DC power source. This allows the traffic light to be powered by a transformer supplying the conventional 240V AC, a battery or solar panel. This is advantageous in providing a traffic management system with enhanced versatility and portability.

In this embodiment, a printed circuit board (PCB) heat sinked LED driver 22 is controlled by the microchip 16 and also electronically connected to the power source 18.

The heat sink is provided and designed to dissipate heat efficiently to reduce the likelihood of overheating of the LEDs. The heat sinked LED driver 22 is provided to supply additional power to the panel 12.

The microprocessor also includes an output section link 24 which is controlled by the microchip 16 to control power supply to a selected or designated driver circuit for one of three colours, namely red, amber and green. The microprocessor is programmed to operate multiple colour LEDs by controlling three driver circuits, each of the driver circuits being responsible for the operation of the LEDs responsible for displaying a selected colour on a selected panel.

Furthermore, the microprocessor has an additional driver 26 which is in communication with the LED driver 22. The additional driver 26 is provided to control the larger 300mm panel described above or an additional LED panel. The additional LED panel may be customised for displaying for example signs for cyclists or speed limit signs.

Optionally, the microprocessor includes a push button 28 which is designed to learn a new voltage whenever the button is pushed and generate a signal for the microchip 16 to adjust the brightness of the LEDs.

The microprocessor is programmed to vary the brightness of the LEDs at a predetermined time or for a predetermined period of time as desired. For instance, the driver circuit is capable of progressively dimming the LEDs in accordance with a stepped profile. When one or more of the LEDs have failed, the driver circuit maintains the remainder of the LEDs active at a desired level of brightness. Additionally, when more than a predetermined percentage of the LEDs have failed, the driver circuit is programmed to deactivate the remainder of the LEDs.

In addition to the above, the microprocessor may be programmed remotely to enable various parameters to be set and changed for activation and deactivation of the driver circuit.

The microprocessor has a dual in-line package (DIP) switch 30 electronically connected

to the microchip 16. The DIP switch 30 is designed to customise the behaviour of the LED for specific situations or to control additional software functions.

It should be noted that the LED display system of the present invention can be retrofitted into an existing traffic lantern housing to replace halogen globes.

Now that a preferred embodiment of the present invention has been described in some detail, it will be apparent to a skilled person in the art that the LED display system may offer at least the following advantages:

1. it eliminates the need of a great deal of physical componentry thereby enhancing reliability and reducing energy wastage;
2. it is capable of driving panels of different sizes and hence reduces production and assembly costs but increases versatility;
3. it enables a traffic light aspect to be software driven allowing greater flexibility with respect to functionality and operability;
4. it substantially reduces the likelihood of LED failure due to overheating; and
5. it is retrofittable to an existing traffic light lantern to replace halogen globes.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. All such variations and modifications are to be considered within the scope and spirit of the present invention the nature of which is to be determined from the foregoing description.

Industrial Applicability

The LED display system of the present invention is industrially applicable in that it is retrofittable to an existing traffic light lantern enabling a traffic light aspect to be software driven, allowing greater flexibility with respect to functionality and operability. It also substantially reduces the likelihood of LED failure due to

overheating. Furthermore, it is capable of driving panels of different sizes and eliminates the need of a great deal of physical componentry.

Claims

1. A LED display system including:
   a panel having an array of LEDs;
   means for selectively varying power supply to the panel; and
   detecting means adapted to activate or deactivate one or more of the LEDs.

2. The LED display system of claim 1, wherein the panel is a printed circuit board on which the LEDs are mounted.

3. The LED display system of either claim 1 or 2, wherein the power varying means includes one or more driver circuits adapted to be controlled by or incorporated in a microprocessor.

4. The LED display system of any one of the preceding claims, wherein the power varying means is adapted to operate on a constant current.

5. The LED display system of any one of the preceding claims, wherein the power varying means is adapted to empower one or more panels of different sizes.

6. The LED display system of any one of claims 3 to 5, wherein each driver circuit is capable of varying the brightness of the LEDs at a predetermined time or for a predetermined period of time as desired.

7. The LED display system of any one of claims 3 to 6, wherein the driver circuit is capable of gradually dimming the LEDs in accordance with a stepped profile.

8. The LED display system of any one of claims 3 to 7, wherein when one or more of the LEDs fail, the driver circuit is capable of maintaining the remainder of the LEDs activated at a desired level of brightness.

9. The LED display system of any one of claims 3 to 8, wherein when more than a predetermined percentage of the LEDs fail, the driver circuit is adapted to deactivate the remainder of the LEDs.

10. The LED display system of claim 9, wherein the predetermined percentage is substantially 20%.

11. The LED display system of any one of claims 3 to 10, wherein the driver circuit is adapted to cause flashing of the LEDs for variable lengths of time.

12. The LED display system of any one of the claims 3 to 11, wherein the detecting means is in communication with the microprocessor.

13. The LED display system of any one of the preceding claims, wherein the detecting means includes or is connected to a push button which when activated is adapted to cause flashing of the LEDs for a predetermined period of time.

14. The LED display system of any one of the preceding claims, wherein the detecting means includes one or more of the following: a heat detecting device; a motion detecting device or sound detecting device.

15. The LED display system of claim 14, wherein the motion detecting device includes a trip wire which when triggered is adapted to activate an electronic display board for road users.

16. The LED display system of any one of claims 3 to 15, wherein the microprocessor is programmable so as to enable various parameters to be set and changed for activation and deactivation of the driver circuit.

17. The LED display system of any one of claims 3 to 16, wherein the microprocessor is programmable to operate multiple colour LEDs by controlling more than one driver circuit.

18. The LED display system of any one of claims 3 to 17, wherein each driver circuit is responsible for the operation of the LEDs on a selected panel.

19. The LED display system of any one of claims 3 to 18, which includes an additional drive circuit adapted to control a larger or an additional LED panel.

20. The LED display system of any one of the preceding claims, which is powered by an AC or DC power source.

21. The LED display system of claim 20, wherein the power source is a printed circuit board (PCB) heat sinked LED driver.

22. The LED display system of claim 21, wherein the printed circuit board includes a dual in-line package (DIP) switch adapted to customise the behaviour of the LED.

23. A LED display system substantially as herein described with reference to any one of the accompanying drawings.

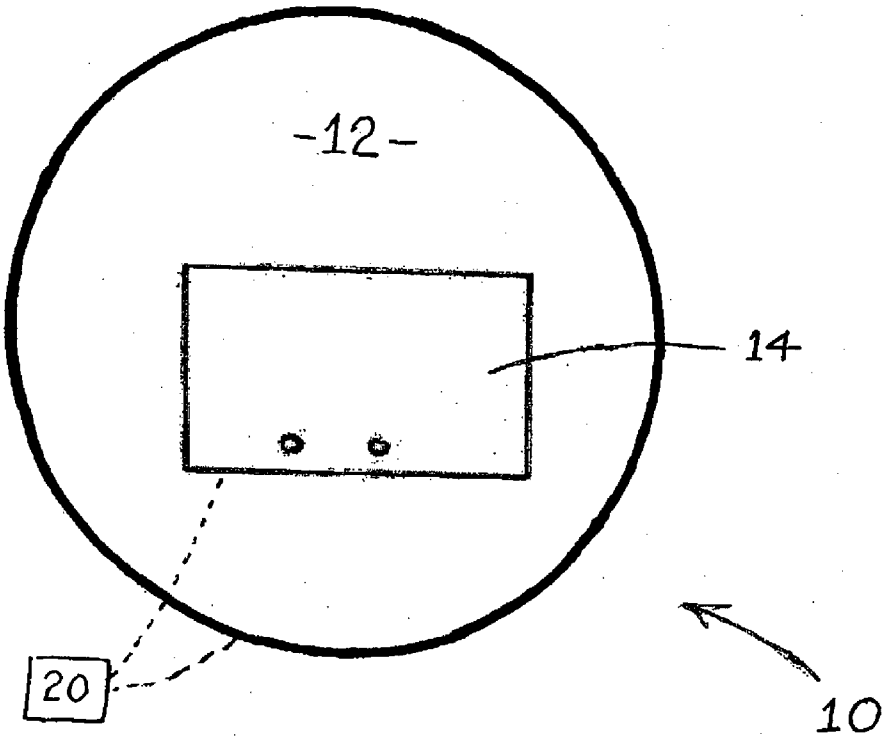


FIG 1

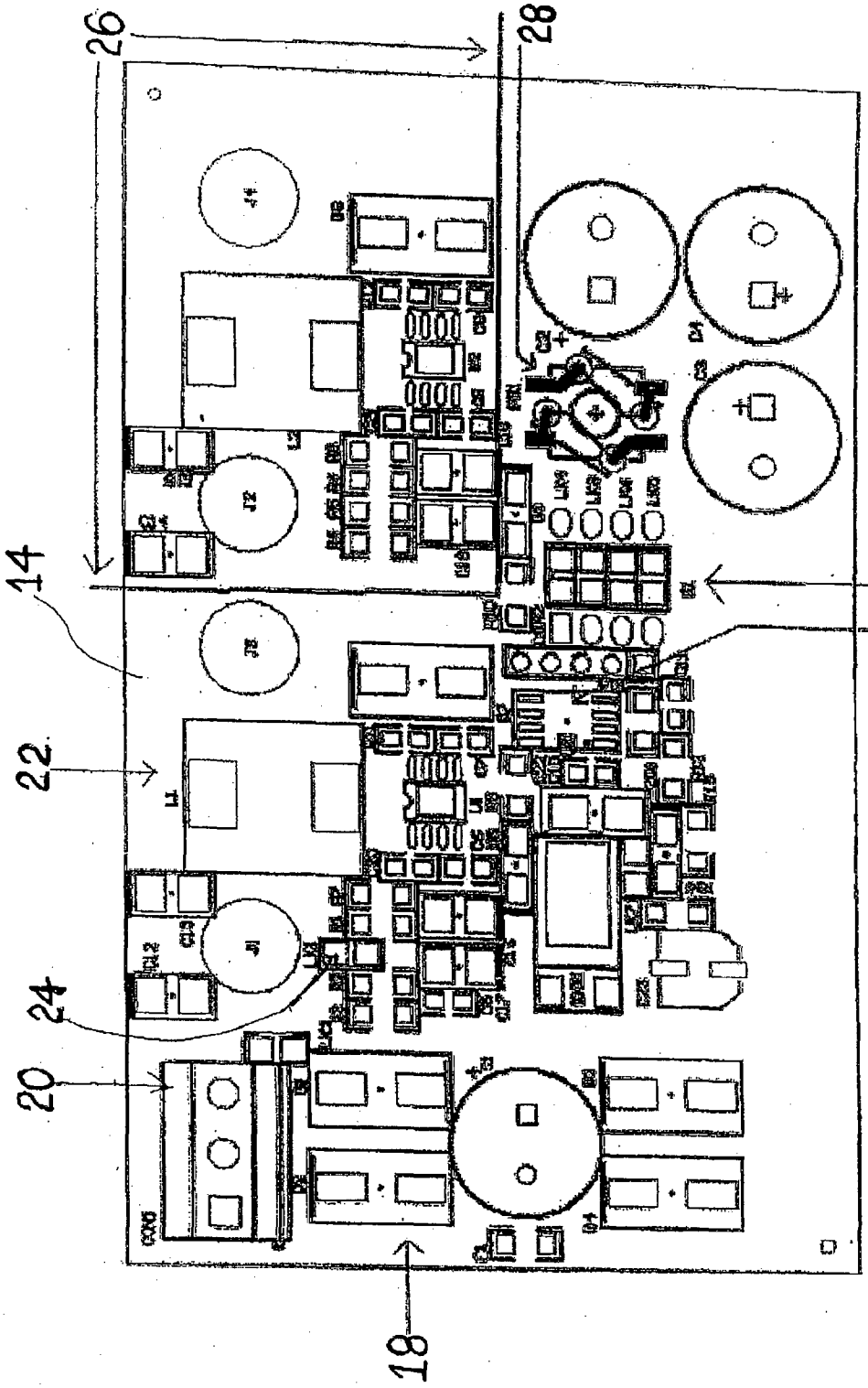


FIG 2

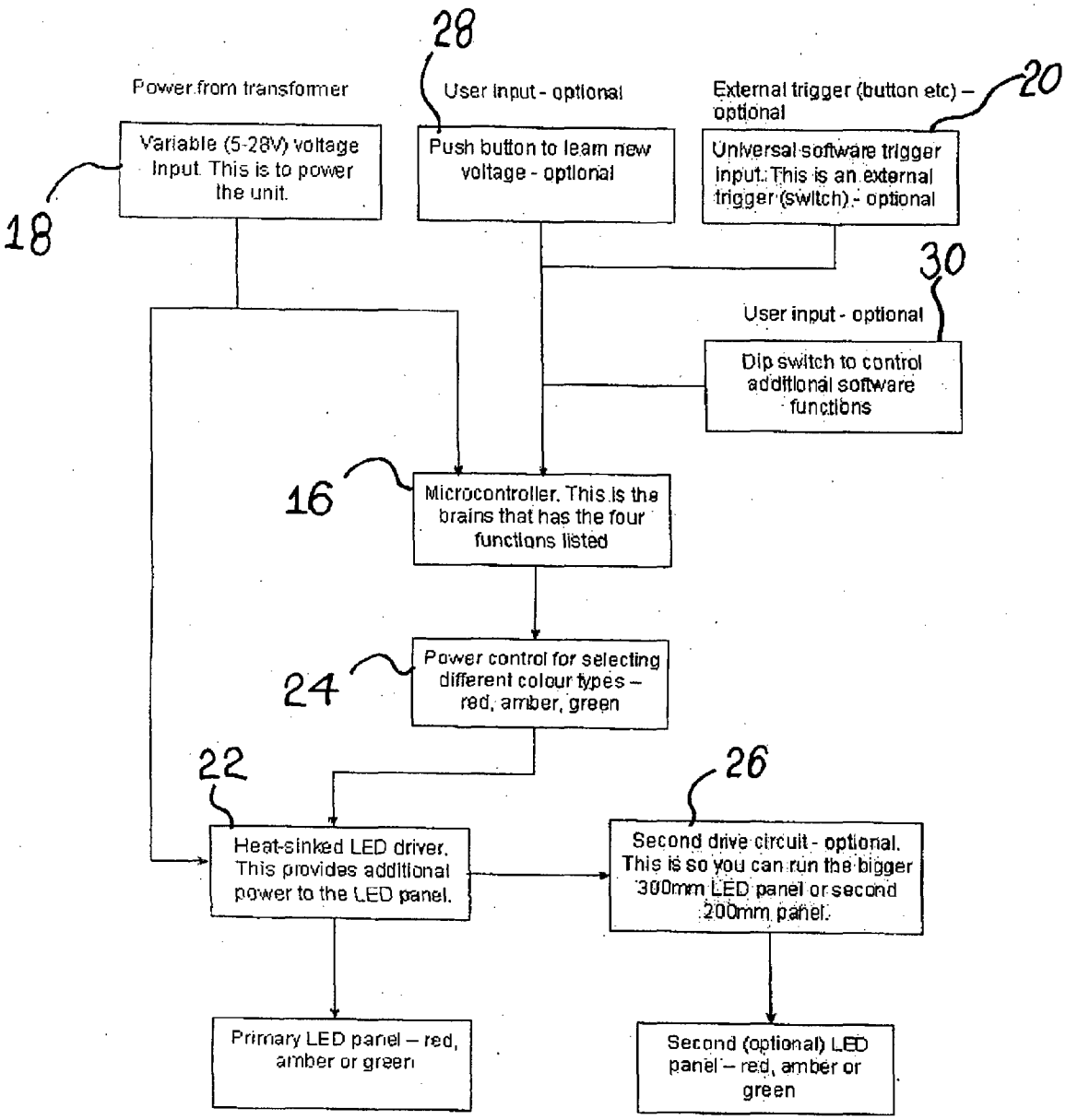

28
Power from transformer
User input - optional
External trigger (button etc) – optional
20
Variable (5-28V) voltage input. This is to power the unit.
Push button to learn new voltage - optional
Universal software trigger input. This is an external trigger (switch) - optional
18
30
User input - optional
Dip switch to control additional software functions
16
Microcontroller. This is the brains that has the four functions listed
24
Power control for selecting different colour types – red, amber, green
22
26
Heat-sinked LED driver. This provides additional power to the LED panel.
Second drive circuit - optional. This is so you can run the bigger 300mm LED panel or second 200mm panel.
Primary LED panel – red, amber or green
Second (optional) LED panel – red, amber or green

FIG 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/001210

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H05B 33/08 (2006.01)

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)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Epoque- Epodoc and wpi, Google Patents, Esp@ceNet: Search terms- (LED, panel, power, varying, PCB, CPU, brightness, detector, traffic, light, driver-circuit, flash) and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2002/052902 A2 (KONINKLIJKE PHILIPS ELECTRONICS N.V.) 04 July 2002 (Abstract, pages 2, 4-5and figures 1, 2, 5)	1, 3-14, 16-22 2, 15
X Y	EP 2012559 A2 (SIEMENS ENERGY & AUTOMATION, INC.) 07 January 2009 (Paragraphs [0019], [0022], [0026-0027], [0030-0032], [0034-0035], [0047])	1, 3-14, 16-22 2, 15
Y	US 2005/0218834 A1 (CHEN) 06 October 2005 (Paragraph [0013])	2
Y	US 6265984 B1 (MOLINAROLI) 24 July 2001 (Column 1)	15

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 November 2010	23 NOV 2010
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **PRADNYA SATARKAR** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2751

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/001210

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: **23**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 23 does not comply with Rule 6.2 (a) because it relies on references to the description and/or drawings.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2010/001210

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	02052902	CN	1291282	CN	1393118	CN	1406450
		EP	1056993	EP	1321012	EP	1348319
		JP	2008198618	US	6127783	US	6445139
		US	6495964	WO	0037904	WO	0223954
EP	2012559	CN	101338870	US	2009009362		
US	2005218834	US	7102538				
US	6265984	NONE					

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX