DESIGN AND CONSTRUCTION OF A 2WATT, 3VOLTS LIGHT EMITTING DIODE (LED) ILLUMINATING DISC LAMP

BY

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Dedication

This project work is dedicated first and foremost to the Almighty God who has been my source of strength and fountain of knowledge. And also to my parents in the persons of Mr. / Mrs. Kolawole Ogunbuyide who, single handedly have been very supportive and instrument to my attaining this height….. God bless them with ripe old age for me

Attestation / Declaration

I, OGUNBUYIDE MOYOSORE S, declare that this work was done by me and has never been presented elsewhere for the award of a degree; I also hereby relinquish the copyright to the Federal University of Technology, Minna.

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Acknowledgement

I want to acknowledge God for the strength and power bestowed upon me since the inception of my under graduate studies to its completion.

To my parent Mr/Mrs. Kolawole Ogunbuyide words are woefully inadequate to express my heartfelt thanks for all God has done for me through you in building me in all clarification of life.

I will definitely not conclude on this acknowledgement without appreciating the contributions and supports of Mr/Mrs. Bamidele Dada, Odaudu Enokela,

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And to others whose name are not mentioned here, God in His infinite mercies will reward each one of your various contributions to my studies.

Abstract

The light emitting diode (LED) offers advantageous properties such as high brightness, reliability, lower power consumption and long lifetime. The biggest potential application for White LEDs is general illumination and lighting.

The design employs a 3 volt dc to power the LEDs which is achieved by full wave rectifier, capacitor, voltage regulator and a zener diode to get the specific output.

With this design, the torchs light output is modest, it is nonetheless quite sufficient to illuminate a pathway for walking.

A convex lens with short focal length is placed in front of the LED to focus the beam.

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CHAPTER ONE

1.1 Introduction

A light-emitting diode (LED) is an electronic light source. The LED was first invented in Russia in the 1920s, and introduced in America as a practical electronic component in 1962. Oleg Vladimirovich Losev was a radio technician who noticed that diodes used in radio receivers emitted light when current was passed through them. In 1927, he published details in a Russian journal of the first ever LED.

All early devices emitted low-intensity red light, but modern LEDs are available across the visible, ultraviolet and infra red wavelengths, with very high brightness.

LEDs are based on the semiconductor diode. When the diode is forward biased (switched on), electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm^2) with integrated optical components to shape its radiation pattern and assist in reflection.

Like a normal diode, the LED consists of a chip of semiconducting material impregnated, or *doped*, with impurities to create a *p-n junction.* As in other diodes, current flows easily from the p-side, or anode, to the n-side, or cathode, but not in the reverse direction. Charge-carriers—electrons and holes—flow into the junction from electrodes with different voltages. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon.

The wavelength of the light emitted, and therefore its color, depends on the band gap energy of the materials forming the *p-n junction*. In silicon or germanium diodes, the electrons and holes recombine by a *non-radiative transition* which produces no optical emission, because these are indirect band gap materials. The materials used for the LED have a direct band gap with energies corresponding to near-infrared, visible or near-ultraviolet light.

LED development began with infrared and red devices made with gallium arsenide. Advances in materials science have made possible the production of devices with ever-shorter wavelengths, producing light in a variety of colors.

LEDs are usually built on an n-type substrate, with an electrode attached to the p-type layer deposited on its surface. P-type substrates, while less common, occur as well. Many commercial LEDs, especially GaN/InGaN, also use sapphire substrate.

Most materials used for LED production have very high refractive indices. This means that much light will be reflected back in to the material at the material/air surface interface. Therefore *Light extraction in LEDs* is an important aspect of LED production, subject to much research and development.

1.2 Objective of the Project

The project is aimed to the design and construction of 2 watts, 3 volts Light Emitting Diode (LED) Illuminating Disc Lamp

The Present Project teaches certain benefits in construction and design, and which give use to the objective described below

1. The objective is to provide an LED lamp that may be used to replace an existing fluorescent lamp
2. Another objective is to provide an LED lamp that is inexpensive to operate
3. A further objective is to produce an LED lamp that is durable and long-lasting
4. The primary objective of the present project is to provide LED lamp having advantages not taught by prior art

Other features and advantages of the present project will become apparent project from the following more detailed description, taken in conjunction with the accompanying drawing illustrate by way of example, the principle of the project

1.3 Methodology

A 2watts, 3volts LEDs illuminating disc lamp is realized by the circuit connecting in series with the LEDs which are also in parallel. The electronic devices and circuit require a dc source for their operation. Since the most convenient and economical source of power is the domestic ac supply, the alternating voltage (usually, $220V_{rms}$) was stepped down to 6V and then converted to dc voltage (usually smaller in value). This process of converting ac voltage into dc voltage is called Rectification and is accomplished with the help of a (i) rectifier (ii) filter and (iii) voltage regulator circuit.

These element put together constitute dc power supply.

The illumination is generated from the LEDs coupled with the dc power supply to produce a super bright light.

•

1.4 Scope of Work

The design of the LED illuminating lamp consist 12 LEDs connected in parallel and also supply the LED. LEDs produce more light per watt than incandescent bulbs. The solid package of the LED is designed to focus its light.

The voltage available for the LED illuminating disc lamp is an ac to dc voltage which also charges the battery which was regulated from 6volts to 3 voltages with the use of zener diode.

CHAPTER TWO

Literature Review / Theoretical Background

2.1 History of LED (Light Emitting Diode)

A LED illuminating disc lamp is one of the simplest projects you can build and it's very interesting as it uses a super-bright White LED.

Electroluminescence was discovered in 1907 by the British experimenter H. J. Round of Marconi Labs, using a crystal of silicon carbide and a cat's-whisker detector. Russian Oleg Vladimirovich Losev independently created the first LED in the mid 1920s; his research was distributed in Russian, German and British scientific journals,[4][5] but no practical use was made of the discovery for several decades. Rubin Braunstein of the Radio Corporation of America reported on infrared emission from gallium arsenide (GaAs) and other semiconductor alloys in 1955. Braunstein observed infrared emission generated by simple diode structures using gallium antimonide (GaSb), GaAs, indium phosphide (InP), and silicon-germanium (SiGe) alloys at room temperature and at 77 Kelvin.

In 1961, experimenters Robert Biard and Gary Pittman working at Texas Instruments found that GaAs emitted infrared radiation when electric current was applied and received the patent for the infrared LED.

The first practical visible-spectrum (red) LED was developed in 1962 by Nick Holonyak Jr., while working at General Electric Company. Holonyak is seen as the "father of the light-emitting diode". M. George Craford, a former graduate student of Holonyak, invented the first yellow LED and improved the brightness of red and red-orange LEDs by a factor of ten in 1972. In 1976, T.P. Pearsall created the first high-brightness; high efficiency LEDs for optical fiber telecommunications by inventing new semiconductor materials specifically adapted to optical fiber transmission wavelengths.

Up to 1968 visible and infrared LEDs were extremely costly, on the order of US $200 per unit, and so had little practical application. The Monsanto Corporation was the first organization to mass-produce visible LEDs, using gallium arsenide phosphide in 1968 to produce red LEDs suitable for indicators. Hewlett Packard (HP) introduced LEDs in 1968, initially using GaAsP supplied by Monsanto. The technology proved to have major applications for alphanumeric displays and was integrated into HP's early handheld calculators.

In the history of LED production, red LEDs were the first to be invented and their output was so dim you could barely see if they were illuminated. You needed a darkened room to see them at all.

Then came Green, Yellow and Orange LEDs. As time went by, the brightness improved and it came to a point where the output would shine into the surrounding air. These were called Super-Bright LEDs. Then came the Blue LEDs. At first it was dull, but gradually the output increased to a dazzling glare. With the combination of Red, Green and Blue, manufactures has the potential of producing a White LED. This was the dream of all LED manufacturers. Since the illumination produced by a LED comes from a crystal, it is not possible to produce white light from a single crystal or "chip". The only way is to combine red, green and blue. As soon as the output of blue came up to the quality of the other colors, a white LED was a marketable product. White LEDs are now with us and the output makes them a viable alternate to the globe. There is an enormous array of LED illuminating disc lamp in the market. A LED illuminating disc lamp is more of a "fun-thing" to see how far LEDs have come in the past few years and see what can be done with a double cell and a handful of components.

2.2 History of Illuminating Lamp

The present invention is directed to a LED illumination lamp for irradiating decorative light on a variety of objects such as bridges, buildings and the like, and more specifically to a LED illumination lamp that has enhanced effect of light decoration, heat dissipation and electric energy saving, while assuring hermetic seal, anti-vibration and waterproofing between lamp components.

The invention relates to the field of illumination systems and particularly to an LED illumination system for illuminating a surface with a defined intensity distribution, with at least one LED semiconductor body which emits light symmetrically to a main beam direction of the LED semiconductor body.

The European patent application EP-A-1 017 222 describes an illumination device which comprises a plurality of light sources and a light conductor which guides the emitted light along its longitudinal direction and emits it onto an illuminated object. The emitting surface of the light conductor has the form of a lens, and light can thus be bundled onto the location of the illuminated object with high intensity.

Such illumination systems are designed for illuminating a more or less extensive object, for instance for purposes of scanning or imaging the object. The light is focused on the object to the greatest extent possible in order to be able to provide the illumination with minimal light output.

In contrast, an illumination system which is employed for illuminating extensive surfaces must satisfy different requirements. The illumination system should be able to irradiate the area with a defined predetermined distribution of illumination intensity. For instance, text or color displays on the illuminated surface require a substantially uniform illumination so that reading of the text is not made unduly difficult and so that color contrasts which are not actually there are not simulated in the color display.

Conventional illumination systems either deliver inadequate results or have a complex and expensive construction.

The object of the present invention is to provide an LED illumination system of the above type with which a surface can be illuminated with a predetermined homogenous illumination intensity distribution, and which has a simple construction and is inexpensive to produce.

Further developments of the invention emerge from the sub claims.

According to the invention, illuminating optics are disposed in an LED illumination system between the at least one LED semiconductor body and the surface that is to be illuminated, which optics deflect the emitted light asymmetrically relative to the main beam direction of the LED semiconductor body.

The asymmetrical deflection makes possible a purposeful setting of the illumination of the surface, regardless of the shape of said surface. Thus, the changing distance to the surface points from the light source and the changing angle at which the light beams strike the surface can be accounted for, given a surface of any shape, by the asymmetric beam deflection of the symmetrically emitted light.

In a development, the illumination system is designed for the uniform illumination of a surface.

In particular, the illumination system can be designed for the uniform illumination of a curved surface, particularly a convex or concave surface.

But it is also possible to utilize the illumination system for the purposeful non-uniform illumination of the surface, for instance so that specific regions of the surface can be optically highlighted or left in the background.

In an advantageous development, the illumination optics are formed by one or more single lenses. If the illumination surface is concave from the perspective of the single lens, the single lens has a concave surface with respect to the LED and a convex surface with respect to the illumination surface.

But corresponding illumination optics can also be formed by one or more Fresnel lenses.

In a preferred development, the illumination system comprises several LED semiconductor bodies which emit in different spectral ranges.

In a particularly expedient development, the light of the LED semiconductor body which is emitted in different spectral ranges is complementary, (i.e. white light is delivered); for instance, three LED semiconductor bodies are provided, one of which emits red light, one green light, and one blue light.

The LED semiconductor body or bodies contain GaN, InGaN, AlGaN, ZnS, InAlGaN, and ZnSe, CdZnS, or CdZnSe semiconductor material and emit visible light or infrared or ultraviolet electromagnetic radiation.

An alternative for generating white light in the illumination system utilizes one or more luminescence conversion elements behind the semiconductor body (or bodies) in its emission direction, which are interposed between the semiconductor body and the lens. Suitable for this purpose is a luminescence conversion element which, if a semiconductor body emits blue light, for instance, converts a portion of the blue light into yellow light or into green light and red light and which blends these with the blue light of the semiconductor body.

In a development, the LED semiconductor body and the illumination optics form an illumination module and are disposed in common module housing.

2.3 Historical Background of Diode

Although the crystal semiconductor diode was popularized before the thermionic diode, thermionic and solid state diodes were developed in parallel.

The basic principle of operation of thermionic diodes was discovered by Frederick Guthrie in 1873. Guthrie discovered that a positively-charged electroscope could be discharged by bringing a grounded piece of white-hot metal close to it (but not actually touching it). The same did not apply to a negatively charged electroscope, indicating that the current flow was only possible in one direction.

The principle was independently rediscovered by Thomas Edison on February 13, 1880. At the time Edison was carrying out research into why the filaments of his carbon-filament light bulbs nearly always burned out at the positive-connected end. He had a special bulb made with a metal plate sealed into the glass envelope, and he was able to confirm that an invisible current could be drawn from the glowing filament through the vacuum to the metal plate, but only when the plate was connected to the positive supply.

Edison devised a circuit where his modified light bulb more or less replaced the resistor in a DC voltmeter and on this basis was awarded a patent for it in 1883. There was no apparent practical use for such device at the time, and the patent application was most likely simply a precaution in case someone else did find a use for the so-called "Edison Effect".

About 20 years later, John Ambrose Fleming (scientific adviser to the Marconi Company and former Edison employee) realized that the Edison effect could be used as a precision radio detector. Fleming patented the first true thermionic diode in Britain on November 16, 1904 (followed by U.S. Patent 803,684 in November 1905).

The principle of operation of crystal diodes was discovered in 1874 by the German scientist Karl Ferdinand Braun. Braun patented the crystal rectifier in 1899. Braun's discovery was further developed by Jagdish Chandra Bose into a useful device for radio detection.

The first actual radio receiver using a crystal diode was built by Greenleaf Whittier Pickard. Pickard received a patent for a silicon crystal detector on November 20, 1906.

Other experimenters tried a variety of minerals and other substances, although by far the most popular was the lead sulfide mineral Galena. Although other substances offered slightly better performance, galena had the advantage of being cheap and easy to obtain, and was used almost exclusively in home-built "crystal sets", until the advent of inexpensive fixed-germanium diodes in the 1950s.

At the time of their invention, such devices were known as rectifiers. In 1919, William Henry Eccles coined the term **diode** from the Greek roots *dia*, meaning "through", and *ode* (from ὅδος), meaning "path".

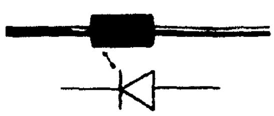

Fig 2.1 Symbol of a diode

2.4 Historical Background of Battery

The name "battery" was coined by Benjamin Franklin for an arrangement of multiple Leyden jars (an early type of capacitor) after a battery of cannon. Strictly, a battery is a collection of two or more cells, but in popular usage *battery* often refers to a single electrical cell.

An early form of electrochemical battery called the Baghdad Battery may have been used in antiquity. However, the modern development of batteries started with the Voltaic pile, invented by the Italian physicist Alessandro Volta in 1800.

In 1780 the Italian anatomist and physiologist Luigi Galvani noticed that dissected frog's legs would twitch when struck by a spark from a Leyden jar, an external source of electricity. In 1786 he noticed that twitching would occur during lightning storms. After many years Galvani learned how to produce twitching without using any external source of electricity. In 1791 he published a report on "animal electricity." He created an electric circuit consisting of the frog's leg (FL) and two different metals A and B, each metal touching the frog's leg and each other, thus producing the circuit A-FL-B-A-FL-B...etc. In modern terms, the frog's leg served as both the electrolyte and the sensor, and the metals served as electrodes. He noticed that even though the frog was dead, its legs would twitch when he touched them with the metals.

Within a year, Volta realized the frog's moist tissues could be replaced by cardboard soaked in salt water, and the frog's muscular response could be replaced by another form of electrical detection. He already had studied the electrostatic phenomenon of capacitance, which required measurements of electric charge and of electrical potential ("tension"). Building on this experience, Volta was able to detect electric current through his system, also called a Galvanic cell. The terminal voltage of a cell that is not discharging is called its electromotive force (emf), and has the same unit as electrical potential, named (voltage) and measured in volts, in honor of Volta. In 1800, Volta invented the battery by placing many voltaic cells in series, literally piling them one above the other. This Voltaic pile gave a greatly enhanced net emf for the combination, with a voltage of about 50 volts for a 32-cell pile. In many parts of Europe batteries continue to be called piles.

Volta did not appreciate that the voltage was due to chemical reactions. He thought that his cells were an inexhaustible source of energy, and that the associated chemical effects (e.g. corrosion) were a mere nuisance, rather than an unavoidable consequence of their operation, as Michael Faraday showed in 1834. According to Faraday, cations (positively charged ions) are attracted to the cathode, and anions (negatively charged ions) are attracted to the anode.

Although early batteries were of great value for experimental purposes, in practice their voltages fluctuated and they could not provide a large current for a sustained period. Later, starting with the Daniell cell in 1836, batteries provided more reliable currents and were adopted by industry for use in stationary devices, particularly in telegraph networks where they were the only practical source of electricity, since electrical distribution networks did not then exist. These wet cells used liquid electrolytes, which were prone to leakage and spillage if not handled correctly. Many used glass jars to hold their components, which made them fragile. These characteristics made wet cells unsuitable for portable appliances. Near the end of the nineteenth century, the invention of dry cell batteries, which replaced the liquid electrolyte with a paste, made portable electrical devices practical.

Since then, batteries have gained popularity as they became portable and useful for a variety of purposes.

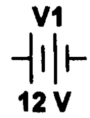

Fig 2.2 symbol of a battery

2.5 LEDs and Illumination

LED lamps are used for both general lighting and special purpose lighting. Where colored light is required, LEDs come in multiple colors, which are produced without the need for filters. This improves the energy efficiency over a white light source that generates all colors of light then discards some of the visible energy in a filter.

White-light light-emitting diode lamps have the characteristics of long life expectancy and relatively low energy consumption. The LED sources are compact, which gives flexibility in designing lighting fixtures and good control over the distribution of light with small reflectors or lenses. LED lamps have no glass tubes to break, and their internal parts are rigidly supported, making them resistant to vibration and impact. With proper driver electronics design, an LED lamp can be made dimmable over a wide range; there is no minimum current needed to sustain lamp operation. LEDs using the color-mixing principle can produce a wide range of colors by changing the proportions of light generated in each primary color. This allows full color mixing in lamps with LEDs of different colors. LED lamps contain no mercury.

However, some current models are not compatible with standard dimmers. It is not currently economical to produce high levels of lighting. As a result, current LED screw-in light bulbs offer either low levels of light at a moderate cost, or moderate levels of light at a high cost. In contrast to other lighting technologies, LED light tends to be directional. This is a disadvantage for most general lighting applications, but can be an advantage for spot or flood lighting.

CHAPTER 3

Design and Implementation

3.1 Principle of Operation / Block diagram

This chapter will give thorough description of design of a 2watts 3volts LED illuminating disc lamp. It is divided into three sections, the power supply, the charging unit and LED Output

The block diagram of the 2watts, 3volts LED illuminating disc lamp under construction is given below

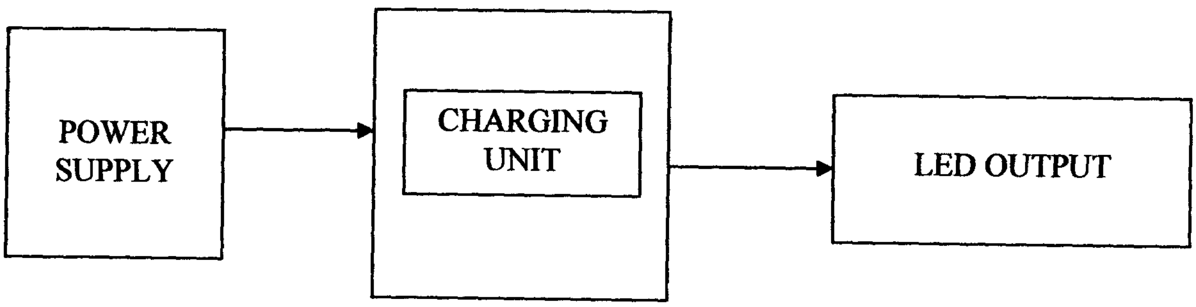

FIG 3.0 BLOCK DIAGRAM OF A 2WATTS 3VOLTS LED ILLUMINATING DISC LAMP

3.2 Power Supply Stage

Most electronic devices require d.c. power for their operation. The most convenient way of obtaining d.c. power is from the conventional a.c. power by using rectifier and filter systems. The diagram of fig. 3.1 shows a power supply unit.

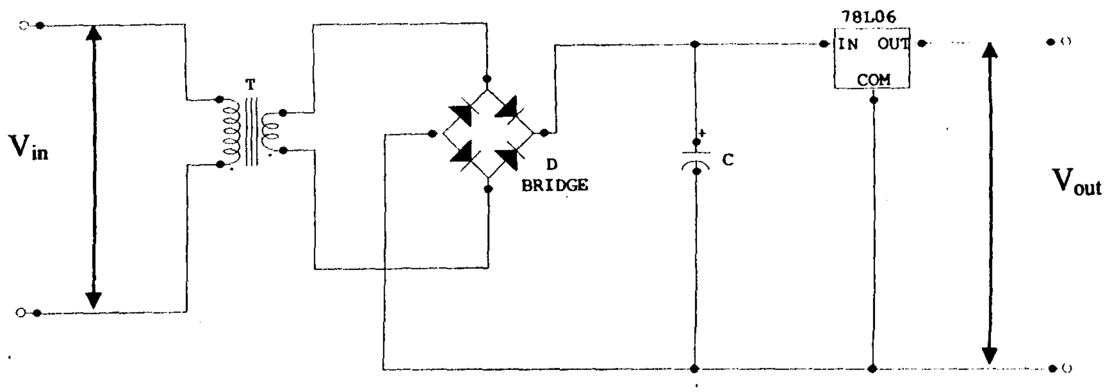

Fig.3.1 Power supply stage circuit

A 220/12V, 300mA step down transformer was selected for the design in order to get the required 6V needed for the operation of the system. The maximum output voltage is given by

$$V_{max} = \sqrt{2}V_s \qquad \text{... (3.1)}$$

Where V_{max} is the maximum output voltage, V_s is the output voltage.

$\sqrt{2} \times 12 = 16.97V$

The d.c. voltage of the output is given by;

$$V_{dc} = \frac{2V_{max}}{\pi} \qquad \text{... (3.2)}$$

$V_{dc} = (2 \times 16.97)/\, 3.1412 = 5.3V$

For full wave rectification, there will be a voltage drop of $2V_D$ ($V_D = 0.65V$).

Therefore,

$V_{dc} = 10.80 - 2V_D$

$10.80 - 1.3V$

$V_{dc} = 9.50V$

The output of a rectification consists of d.c. components and a.c. components known as ripple. The a.c component is undesirable and accounts for pulsations in the rectification. It is therefore necessary to eliminate the a.c. components to have a pure d.c, hence the use of filter capacitor. Using the following relation

$$V_r = \frac{1}{4\sqrt{3}fC} \quad \text{... (3.3)}$$

Where V_r is the ripple voltage, f is the frequency, C is the filter capacitor.

$$C = \frac{1}{4\sqrt{3}fV_r} \quad \text{... (3.4)}$$

$C = 1/(4\sqrt{3} \times 50 \times 1.93)$

$C = 1495\mu F$

For efficient design, a value of 1000μF was chosen. A voltage regulator integrated circuit 7806 was used to maintain a steady output of 6V.

To get the desired voltage which is 3V, 3V zener diode was used to get about 3.6 which is the characteristic voltage, which goes to the LED.

3.3 The Charging Stage

The charging unit is an electrical device that is used for putting energy into the battery. The battery charger changes the a.c from the power line into d.c suitable for charger.

In general, a mains-operated battery charger consists of the following elements:

1. A step-down transformer for reducing the high a.c mains voltage to a low a.c voltage
2. A full-wave rectifier for converting alternating current into a direct current
3. A charger-current limiting element for preventing the flow of excessive charging current into the battery under charge
4. A device for preventing the reversal of current i.e. discharging of the battery through the charging source when the source voltage happens to fall below the battery voltage.

The charging process of the circuit is shown in the figure below

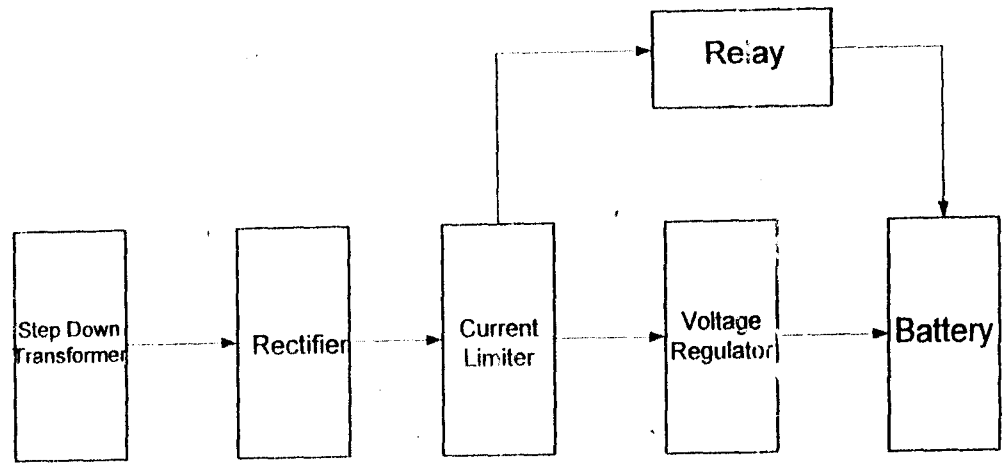

Fig 3.2 modern battery charger

3.5.1 Charging system

In this circuit system, the battery is floating on the line and is so connected that it is being charged when the load demands are light and automatically discharged during peak periods when load demands is heavy or when the usual power supply fails or is disconnected.

For batteries other than floating type, this method is employed.

The constant-voltage system

In this method of charging, the voltage is kept constant but it results in very large charging current in the beginning when the back e.m.f of the cell is low and a small current when their back e.m.f increases on being charged.

When a battery of such cells is being charged, then the e.m.f of the cells acts on opposition to the applied voltage. If V is the supply voltage which sends a charging current of I against the back e.m.f. E_b, then input VI but the power spent in overcoming the opposition is E_bI. This power E_bI is converted into the chemical energy which is stored in the cell. The charging current can be found from the following equation

$I = V - E_b / R$

Where R = total circuit resistance including internal resistance of the battery

I = charging current

By varying R, the charging current can be kept constant throughout.

3.4 LED Output Stage

This stage consists of resistors, zener diode 1n4001 diode, LEDs as the illuminating Lamp.

The zener diode forms a junction breakdown which is reverse bias and reverse current rises sharply to a value limited (3V) only by the external resistance connected in series to the LEDs. Breakdown will occur, very little further in voltage is required to increase the current to a relatively high value.

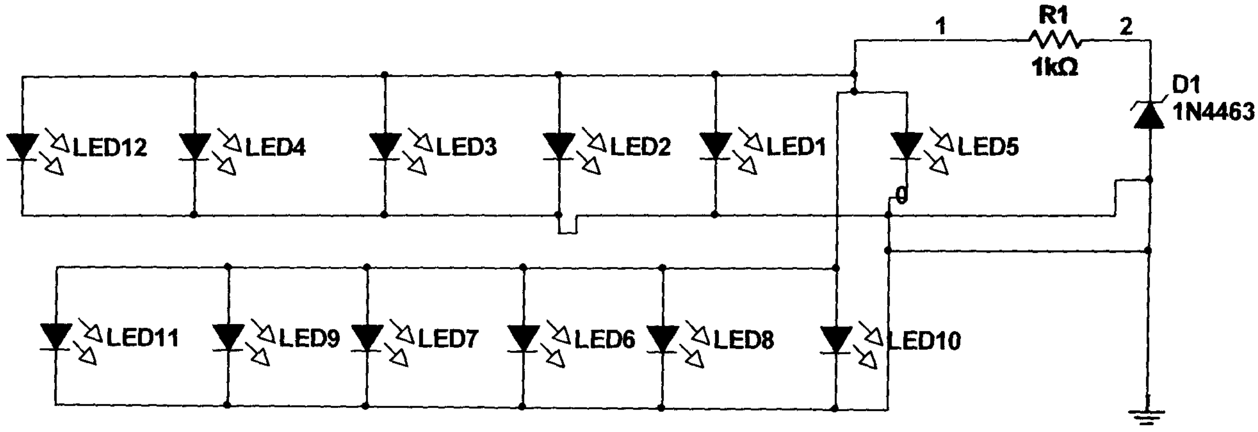

Fig 3.4 circuit diagram of the LED output

For the calculations of a 2watts LED Lamp to know the numbers of LEDs to be used, some parameters are know like

Power = 2watt

Voltage = 3 volts

I_f = 60 mA

V_f = 1.66 V

Power = IV, then

I = P / V

= 2 / 3 = 0.66 ≡ 0.7

I = 0.7A total current in the circuit

Forward current for One(1) LED = 60mA = 0.06A

To get the numbers of LEDs to be used = I / forward current for one (1) LED

Hence, the number of LEDs = 0.7 / 0.06 = 11.66 ≡ 12 LEDs to used

3.4.1 Luminous Intensity

And to calculate for the luminous intensity of a point source in any particular direction is given by the luminous flux radiated out per unit solid in that direction. In other words, it's solid angular flux density of a source in a specified direction.

The type of source used is a surface source. The source is of infinite area and of uniform brightness; illumination at any point facing the source is independent of the distance between the surface sources.

The specific output or efficiency of a lamp is the ratio of luminous flux to the power intake. It unit is lumen/watt (lm/W).

The 3candala LED produced a brighter, whiter light

Area of the surface = 2(lh) + 2(lw) + 2(wh)

Where l = 2, h = 12, w = 8.5

$= 2(2 \times 12) + 2(2 \times 8.5) + 2(8.5 \times 12) = 286cm^2$

Area of the surface = $286cm^2$

Luminous intensity = 3 candela

Brightness is defined as the luminous intensity divided by the projected area

projected area = A cos 60

$$= 286 \times \cos 60$$

$$= 143\text{cm}^2$$

$$B = 3 / 143 \times 10^{-4}$$

$$= 2.09 \times 10^5 \text{ cd/m}^2$$

3.5 Design Implementation

All the components making up the circuit were obtained and assembled achieve the objectives of this project. The process consisted of several stages as explained in this chapter.

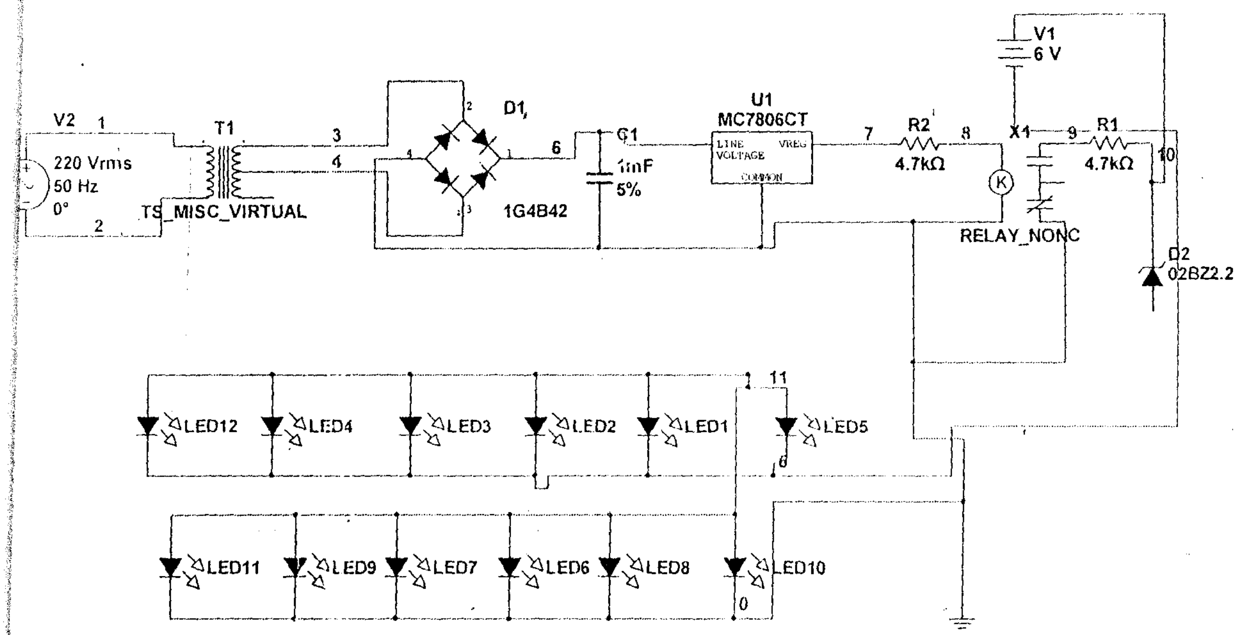

Fig 3.5 Circuit Diagram of a 2watt, 3volts LED illuminating Disc Lamp

CHAPTER FOUR

Tests, Results and Discussions

4.1 Main Constructed Circuit Tests

The implementation of the project was done in two stages: the breadboard stage and the veroboard stage.

The breadboard provides a temporary platform to couple component and ensure that the circuit design is workable before being transferred to a permanent platform, the veroboard , which involved soldering of the of the circuit component using 15W soldering iron to ensure that the component are not being overheated in the course. The first part involved the connection of full wave rectifier, capacitor, and voltage regulator with power supply in place. This component is to convert an AC power supply to DC power source to be able to charge a 6V rechargeable battery. A 6V relay is also connected to the vero board to be able to switch ON/OFF the circuit to the battery when power supply fails.

This chapter presents the test that was carried out on the implemented system and the results obtained from the test carried out.

4.2 Testing and Result

The design when tested confirmed at the output of the circuit going to the LED was 3.65V and the output of the circuit when going to battery for charging was 5.87V. A super bright light was produced at the output of the LED.

4.3 Casing

The casing of the circuit was carried out using a Cardboard material leaving the LED light covered with a transparent glass. The prototype design is meant to be a portable device. The dimensions of the casing are approximately 21.5cm × 8.3 cm × 9cm

4.4 Further Discussion of Result

(i) From the result obtained from the test, the design is said to be in good order

(ii) The voltage was at the characteristic value at 3.4 Volt

(iii) The LEDs output was achieved and effective, the light a super bright.

CHAPTER 5

Conclusion

5.1 Summary

The 2watts, 3volts Light Emitting Diode (LED) illuminating Disc Lamp is a simple touch light that when connected in parallel with a DC voltage circuit gives a super bright light. The 2watts, 3volts Light Emitting Diode (LED) illuminating Disc Lamp comprises of three section namely, Power supply, Charging Unit and the LED output.

The power for the design is obtained from a centre tapped transformer, then rectification by the full wave bridge rectifier, filtered with capacitor and voltage regulator to give a desired output. The charging unit also comprises of the conversion of AC to DC connection which charges the battery, while the LED output illuminate a bright light.

5.2 Problem Encountered

There was difficulty in obtaining the specific output. There was also a serious problem in on the relay, first for the commonly open and commonly close.

When I was given the project to produce a LED illuminating disc lamp, i wanted to fit the circuit into a 2-cell torch but a white LED requires about 3.4v operating, and two cells produce only 3v. So I had to think of a number of ways around the problem. That's why I have produced a circuit.

As you know, a LED will not operate on a voltage below its characteristic voltage. It simply will not operate AT ALL. This characteristic voltage depends on the type of LED and a super-bright LED is about 3.1v - 4v

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