DESIGN AND CONSTRUCTION OF PORTABLE RECHARGEABLE LAMP USING ENERGY BULB

BY

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TITLE PAGE

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF SCIENCE LABORATORY TECHNOLOGY IN PARTIAL FULFILLMENT FOR THE AWARD OF NATIONAL DIPLAMA IN SCIENCE LABORATORY TECHNOLOGY, ADAMAWA STATE POLYTECHNIC, YOLA.

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APPROVAL PAGE

The project report "construction of rechargeable lamp using energy bulb" by Godiya Yawale & Hyellafiya Daniel met the regulations governing for the award of national diploma in Science Laboratory Technology, Adamawa State Polytechnics Yola and is approved for its contribution to knowledge and literature presentation.

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DEDICATION

This project is dedicated specially to Almighty God for granting us life, ability to withstand stresses and all that were required for the accomplishment of the project and entire programs.

ABSTRACT

The design and construction of rechargeable lamp energy bulb is presented in this report. The rechargeable lamp is an emergency lighting device which is normally powered by a battery that is recharged when there is power supply to it and discharges through a load which is energy bulb when power supply is cut off. The rechargeable lamp is renewed as its component consists of a 12v step down transformer with center tap, the bi-phase rectifier, the filter, the battery, the inverter and load. The design and analysis of the lamp are explained in detail including the test carried out and the result obtained. Recommendations are also stated for improvements.

Acknowledgement

All thanks to the Almighty God for the strength and ability he has given us to carry out this project research successfully and we also wish to thank our parents, love once and well-wishers for their prayers and support.

Special thanks go to Mall. Hassan Yuguda the supervisor of this project for his supervision and his assistance to produce this marvelous project, May the Almighty God bless him abundantly. And to all the lecturers of Science Laboratory Technology department for impacting into us relevant knowledge, may God continue raining of their garden of understandings. Amen.

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CHAPTER 0NE

INTRODUCTION

Background of the Study

A lantern is a portable lightening device used to illuminate broad area's. lantern's may also be used for signaling as torches, or as general light source. The term "lantern" is also used more generally to mean a light source or the enclosure for a light source. Rechargeable lanterns are very usefully electrical gadgets which are quite popular during instant power failure from the national grids. The lantern could be instantly be illuminated through battery backup and never allow us to stumble in the darkness. Although you will find a Varity of them in different shape and size in the market but having your own emergency lantern at home at lower cost than the one being sold in the commercial places can be an experience. It will not only help you to create a quality design but also will acquaint you to the technical aspect of the system under consideration. (Erickson & Maksimovie, 2001).

There are series of challenges concerning power supply especially in the third world countries. The developed countries have been able to ameliorate due to their technological advancement in their power sector. (Floyd, 1989).

In Nigerian, our power supply is epileptic and very unreliable and that has made the citizen of this country to look for alternative especially when there is power outage at night, they must common alternative is the generator which is powered by either diesel or patrol and this is not affordable to many Nigerians. From observation, it was noted that most individuals who could not afford generator set use candles and kerosene lamps. (Keitt 1989).

1.2 Statement of the Problem

The use of generator requires an operator to start it and switch the power supply source to generator which is time consuming and laborious. Most people especially the rural communities are in serious need of affordable alternative electricity source that can provide adequate illumination in the night. This work has evolved a robust and low cost alternative source of illumination in the form of rechargeable lamp.

1.3 Aim and Objective of the Design

The key objective of this project is to come up with a robust reliable and low cost rechargeable lantern that can be powered directly from AC mains for purpose of charging the battery which speed use whenever there is reconstruction during the night. The lantern that will be designed when fully charged can operate continuously for a very long time period 6 hours before running down.

1.4 Significance Of The Study

This paper is vaery important mas it can be used as an illumination souarce for students, shops and homes. The use of rechargeable lamp unit like the work is also an avenue of translating the theoretical lessons received in the class into practical reality thuqs, enhancing the technical skills of the researchers.

1.5 Limitation Of The Study

The study is limited to the society. due to the limited time as a result of lectures. test. assignment. examination and insufficient fund.

1.6 Definition Of Terms

1. Transformer: is device for stepping up or stepping down an alternative voltage. It has primary and secondary windings, it has a main core, which is made up of a thin insulated E-shape convert core, no moving part in transformer hence efficiency is high.

2. Rectifier: is an electrical device composed of one or more diodes that convert alternative current (AC) to direct current (DC).

3. Circuit: a system of component forming a complete path for an electrical current.

4. Current: is the rate of flow of charge in a conducting (conductor) material

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter relevant background international required for the design and construction of a rechargeable lamp as given in the works of other authors are reviewed.

The main purpose of a rechargeable lamp is to provide regulated and stable power to load (lamps) regardless of power grid conditions. The need for a rechargeable lamp comes as a solution towards providing light once there is utility power interruption.

2.1 History of Rechargeable Lamp

The history of rechargeable lamp dates back to the early 1920s. The first rechargeable lamp used mercury rectifiers and grid controlled mercury arc tubes. However, this mercury arc power supplies had limited commercialization due to some problems found in their low capacity. They were characterized by poor efficiency, high maintenance (Basso 2008).

During the late 1960s these problems were surmounted when the semi-conductor industry developed a variety of high performance switching. The discovery of these switching devices became significant to power supplies and had a great impact on its industry. Their superior performance characteristics enable them to break through markets that had been unattainable for mercury arc devices. Nonetheless, it was only until 1970s that rechargeable lamps became widely used but with low capacity (Brown 2001)

The light emitting diode (LED) lanterns are brighter because of the small DC current they consume. In this design, we have decided to opt for energy bulb lantern rather than LED lantern because of the availability of the energy bulb and ease of replacement when blown out or damaged (Linda 2002).

2.2 Overview

All systems designed have their unique ways of how they are being realized. It is these variations based on project conceptions, configurations and types of materials used that makes the differences within the products. This project work is therefore built around three main features, namely

- The charging unit
- The storage unit
- The inverting unit

2.2.1 The charging Unit

All secondary batteries require direct current (DC) supply for charging. Basically rechargeable lamps consist of a rechargeable battery or bank of batteries which require constant charging. It is this battery that serves as an alternative power source for the lamp. The charging unit therefore is the one that provides the charging current (DC) for the battery. There are various methods that are employed for charging batteries.

(a) Constant current charging

In this method of charging, the charge rate which is approximately normal is fairly constant throughout the charging period. The battery voltage rises during the charging and to maintain current rates, some adjustments are made, using the variable resistor, which is in series with the battery, regulated voltage. The time required to change the battery depends on the extent of the battery discharge.

(b) Constant potential voltage charging

This method of charging is used for batteries subjected to regulator routines of discharging and charging. Virtually constant applied voltage in the region is about 2.8v per cell with suitable ballast resistor (Floyd 2002).

(c) Boost charging

Charging batteries ordinarily necessitate higher rates where the ampere rates are one hour at twice the normal rates are one hour at twice the normal rate at half-hour. Abnormal increase in electrolytic temperature indicates that boosting had been carried out too far and should be discontinued. This method is not recommended as a regular practice (Harunur 1988).

(d) Low rate charging

In this method of charging, the discharge requirements are at low constant rates and intermitted rates are at average with low values over a given period of time where charging rates are less than normal.25% or more amperes hours then discharged must be put back into battery thereby making the length of time complex charge to be longer (Keitt 1989).

(e) Trickle charging

In this method of charging any low rate charge in ampere is from 0.05-0% of battery capacity. This type of charging is sufficient to balance the internal loss of the battery and therefore, keeps the battery in the fully charging condition. Voltage required depends on temperature, age of battery, rate used and other factors (Humphreys & Brown 1994).

(f) Constant voltage techniques

If constant voltage current is used, voltage is kept constant but this result in a very large charging current. In the starting, the back e.m.f of the cell is low and this results in the little current. As the back e.m.f increase, charging takes place. This method is used for charging lead-acid batteries. It uses a full wave pulsation DC with a centre tapped transformer, which provides full wave rectification. Communication is usually automatic thereby causing a shutdown when fully charged. The battery voltage increases with the charge voltage across the resistor. The resistor can adjust the cut out voltage. While D3 from the four diodes employed for full wave rectification allows trickle charging and prevents discharge in the event of power failure (Sharma 1999).

(g) Constant current technique

Using this float charging technique, the current is kept fairly constant. The current is controlled by the costal connected in the circuit used for batteries that do not show appreciable change in current level after charging. For example nickel, cadmium battery in other to manage the heat generated. The controlled current source is needed to derive the correct current for the type of cell being charged. Parallel charging method is used so that different cells can be charged at the same time avoiding rotary switching technique (Erickson & Maksimouic 2001).

2.2.2 Transformation stage

Transformation is the process of charging the amplitude of an AC input to a suitable value depending on the needed output voltage. This is achieved by using a transformer to either step up or step down the voltage.

A transformer is a device that converts AC from one voltage to another with little loss of power so that the power output is almost equal to the power input. The transformer is made up of the input cell called the secondary. There is no electrical connection between the output coils called the secondary. There is no electrical connection between the two coils instead they are linked by alternating magnetic field in the soft iron core of the transformer (Keith 1989).

The ratio of the number of an each coil called the turn ratio. The step up transformer has more turns on it's secondary than the primary thereby giving a light output voltage. The step down transformer on the other hand has a larger number of turns on its primary low output voltage.

The basic working principle of any transformer is that the primary winding is connected AC input and the coil to the secondary winding. The magnetic circuit coupling the winding is made of special low reluctance laminated steel. A layer of oxide makes the core of several thin sheets of steel all isolated from one another. The eddy current losses are reduced by setting up a magnetic flux $\emptyset_{(1)}$ across the primary by the alternating input voltage. This leak with the alternating flux in the secondary coil. Induce e.m.f = number of turns x rate of change of flux $E = N_{(1)}dt$

$$E = \frac{Nd\emptyset_{(1)}}{dt}$$

$$\frac{d\emptyset_{(1)}}{dt} = \frac{e}{N}$$

Since the sum of the flux links both coils cross multiplying gives us turns ratio

$$\text{Turns } \frac{Ep}{dt} = \frac{Np}{N_s}$$

Where E_p = primary voltage: N_p = primary turns; E_s = secondary voltage; N_s = secondary turns if $N_S > N_{p,}$ then the transformer is a step up. However, if $N_s < N_s$, then it is a step down transformer.

There are three power losses and they are:

- The copper loss (I^2R) is the loss in the copper windings. The current flowing in them causes this.
- The hysteresis loss is small, energy lost each time AC primary current is reversed using low reluctance steel can reduce this.
- The eddy current loss is caused by back e.m.f and is reduce by using a laminated core (Harumur 1988).

2.2.3 Rectification:

Almost every solid state device requires DC voltage to operate. Batteries are useful as phase type devices but since their operation is limited, it has to be recharged and this is achieved with an alternative power supply source, which is the $50HZ, 220V_{rms}$ AC voltages by using a rectifier.

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important because it process full wave varying

DC. A full wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only used the positive parts of AC wave to produce half wave varying DC. This is also known as the single phase half wave rectifier (Luo & Rashid 2005).

2.2.4 The smoothing stage:

The output voltage of the rectifier stage contains some ripples voltage (pulsating DC). Filter capacitor is connected across the rectifier to smoothen the pulsating DC. As the pulsating DC is applied across the capacitor, It changes to the peak applied voltage between peaks, the capacitor discharge through the load and the voltage gradually drops. The amount voltage drop before the capacitor begins to change again is called ripple voltage. The DC voltage of the rectifier will therefore be smoothen to pure dc voltage supply to ensure that the connected DC battery charge properly.

2.2.5 The storage Unit:

A rechargeable battery is an energy storage device that can be charged again after being discharged by applying DC current to its terminals (output of the charging unit).

Rechargeable batteries allow for multiple usages from a cell, reducing waste and generally providing a better long-term investment in terms of job creation and improve skill man power training industries. This is true even factoring in the higher purchase price of rechargeable and the requirement for a charger.

A rechargeable battery is generally a more sensible and sustainable replacement to one-time use batteries, which generate current through a chemical reaction in which a reactive anode is consumed. The anode in a rechargeable battery gets consumed as well but at a slower rate, allowing for many charges and discharges.

While in use, rechargeable batteries are the same as conventional ones. However, after discharging the batteries are placed in a charge or in the case of built-in batteries, an AC/DC adapter is connected.

While rechargeable batteries offer better long term cost and reduce waste, they do have a few coils. Many types of rechargeable cells created for consumer devices, including AA and AAA, C and D batteries, produce a lower voltage of 1.2V in contrast to the 1.5V of alkaline batteries. Although this lower voltage do not prevent current operation in properly designed electronics, it means a single charge do not last long or offer the same power in a session. This is not the case, however, with lithium polymer and lithium ion batteries.

Some types of batteries such as nickel cadmium and nickel meter hydride can develop a battery memory effect when only partially discharged, reducing performance of subsequent charges and thus battery life in a given device.

Rechargeable batteries are used in many applications such as cars, lighting, electronics signals etc. the most common rechargeable batteries are lead Acid, Nicd Nimh and Li-Ion.

Cell: a cell or a battery is a power supply that uses chemical energy to make electricity.

A primary cell or battery is one that cannot easily be recharged after one use, and are discharged following discharge. Most primary cells utilize electrolytes that are contained within absorbent material or a separator (i.e. no free or liquid electrolyte), and are thus termed dry cells.

A secondary cell or battery is one that can be electrically recharged after use to their original pre-discharge condition, by passing current through the circuit in the opposite direction to the current during discharge. The following graphic evidences the recharging process.

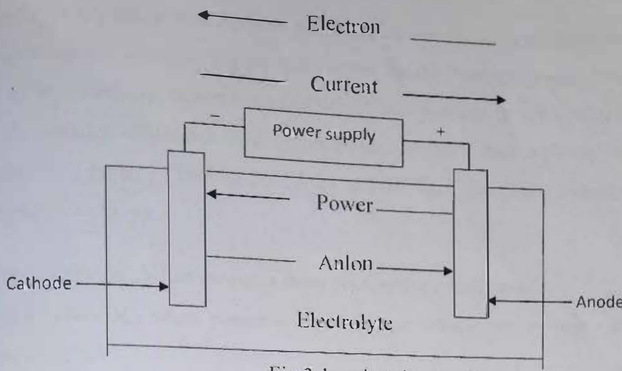


Fig 3.1 recharging a cell

Voltaic cells: A voltaic cell (also known as a Galvanic cell) is an electrochemical cell that uses spontaneous redox reactions to generate electricity. It consists of two separate half-cells. A lalf-cell is composed of an electrode (a Strip of Metal. M) Within a solution containing M^{n+} ions in which M is any arbitrary metal. The two half-cells are linked together by a wire running from one electrode to the other. A salt bridge is also connected to the half cells.

The inverting unit:

A power inverter or inverter is an electronic device or circuitry that changes direct current (DC) to alternating current (AC) by Luo & Rashid (2005).

The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power. the power is provided by the DC source.

A power inverter can be entirely electric or may be a combination of mechanical effect (such as a rotary apparatus) and electronic circuitry. Static inverters do not use moving parts in the conversion process.

Input and output voltage

Input voltage: A typical power inverter device or circuit requires a relatively stable DC power source capable of supplying enough current for the intended power demands of the system. The input voltage depends on the design and purpose of the inverter. Examples 12VDC for smaller consumer and commercial inverters that typically run from a rechargeable 12V battery (Theraja 2005). 24 and 48VDC, which are common standards for home energy systems.

- 200 to 400VDC, when power is from photovoltaic solar panels.
- 300 to 450VDC, when power is from electric vehicle battery peaks in vehicle to grid system.

Output waveform: An inverter can produce a square wave, modified sine wave, pulsed sine walls, pulse width modulated wave (PWM) or sine wave depending on circuit design. The two dominant commercialized wave form types of inverter as of 2007 are modified sine wave and sine wave.

CHAPTER THREE

METHOD AND MATERIALS

3.0 Introduction

In this chapter, detailed design involving calculations and critical selection of various components are considered. Construction procedures are also considered.

Block diagram of a rechargeable lamp using energy bulb.

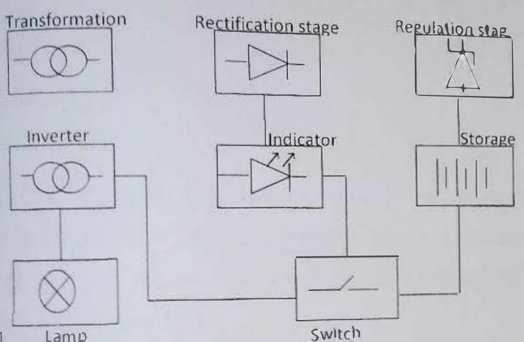


Fig 3.1

Output current (I_o) : 500mA

Output power: 25 Watt

Maximum DC voltage = 12v

AC Main Power Supply

The AC main supply is the basic source of power supply for the project the 220V/12V step-down transformer. A suitable plug is used to connect the circuit with the wall socket outlet and a switch is used to break the connection

Materials

- Capacitor
- Circuit
- Coil
- LED
- plug wire
- Rectifier
- Resistor
- Switch
- Transformer

3.1 Charging unit

The basic principle of rechargeable lamp is that batteries are used as an alternative power supply in time of grid power outage. The battery requires DC voltage for charging. The charging unit is the unit that supplies the charging current that charges the batteries. The charging unit comprises:

i. Step-down transform

ii. Rectification

iii. Filtering

(a) Transformer

The transformer is a step-down transformer with centre tap at the secondary terminal as shown in fig.

The rating of the transformer:

220V/12V 500mA

Frequency of supply = 50Hz

Rating in VA = V_{rms} × current rating

$= 12 \times 500 \times 10^{3} = 6.0VA$

$V_{rms} = 12V$

$V_{rms} = 0.707\, V_{max}$ --------------------------3.1

$V_{rms} = \frac{Vrms}{0.707}$

$= \frac{12}{0.707}$

$= 16.97 \simeq 17$

(b) Rectification

The system of rectification was the bi-phase rectification using two diodes. The choice IN4001 as the rectification diode was based on the fact that maximum normal forward current is 1A for IN4001 while the maximum current of the transformer 500mA. Also the peak Inverse voltage (PIV) rating of IN4001 is 50V while transformer can only present a peak inverse voltage as calculated below

$V_{rms} = \frac{Vmax}{\sqrt{2}} = 0.707\, V_{max}$ --------------------3.2

$V_{dc} = \frac{2Vmax}{\pi} = 0.636 V_{max}$ --------------------3.3

$V_{dc} = 0.636 V_{max}$

$V_{max} = \frac{VDC}{0.636}$

$= \frac{12V}{0.636}$

$= 18.87V$

$V_{max} \simeq 19V$

But $V_{rms} = 0.707_{max}$

$V_{rms} = 0.707 \times 9K8.87$

$= 13.33\ V$

Peak inverse voltage (PIV) = $2V_{max}$ ---------------------3.4

$PIV = 2 \times 18.87 = 37.74$

$PIV \simeq 38V.$

(c) Filtration

Due to the fact that a pure DC 12V is expected from the charging unit, the filter capacitor are used to smoothen the pulsating DC output of the rectifiers. The value of the filter capacitor is calculated below

$V_r = \frac{IL}{2FC}$ --------------------------3.5 by Erickson

Where:

IL=maximum current to be demanded

F=frequency of the input voltage

V_r=ripple voltage

V_{rms}=voltage after rectification

$V_{rms} = \frac{Vmax}{\sqrt{2}}$

$V_{max} = V_{rms} \times \sqrt{2}$

$= 12 \times 1.414 = 16.97V$

Frequency F=50Hz

Assuming a ripple factor (r) 07.7%

V_r = ripple factor $\times V_{max}$ ---------------------------3.6

$V_r = 0.07\times 16.96$

$V_r = 1.185V$

From equation--------------------------3.5

$C = \frac{IL}{2VrF}$

$IL = 0.022$

$C = \frac{IL}{2VrF}$

$= \frac{0.022}{0\times100\times1.188}$

$= \frac{0.022}{237.6}$

$C = 9.4\times 10^{-5} = 94\mu F$

∴The filter capacitor required is $94\mu f$

(d) Indicator

LED is used to indicate battery charging as shown in the circuit diagram. The LED is connected in series with a resistor and the value will be calculated below

$V_{DC} = V_{R1} + V_{D3}$

But $V_{D3} = 2V$ operating voltage

$I_{D3} = 10mA$ sate biased current

$12 = 2 + V_{r1}$

$V_{R1} = IL60\times R_1$

$R_1 = \frac{10V}{10mA}$

$$\frac{10}{0.001} = 1K\Omega$$

Standard value is 1KΩ

The complete circuit diagram of the charging unit is shown below

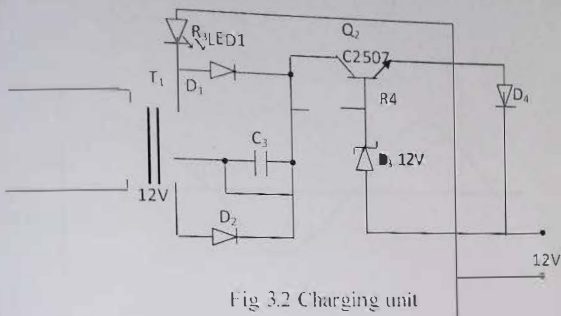


Fig 3.2 Charging unit

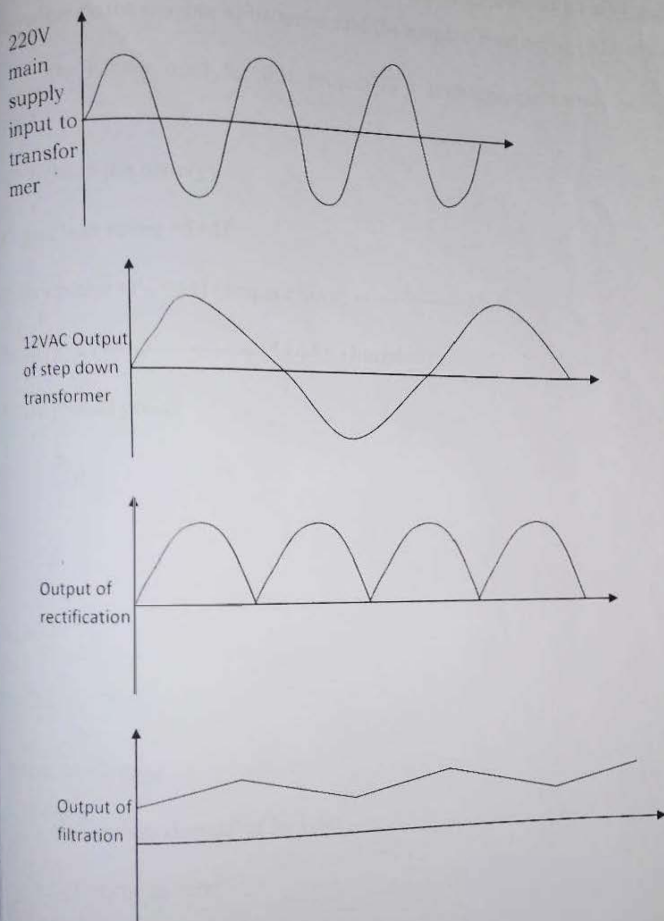


Fig 3.3 waveform of transformer, rectification and filtration.

and

3.2 Battery unit:

The backup battery is position in the circuit where the charging unit and the inverter unit can be connected to it. It can be single battery or more than one battery.

When we have more than one battery, they are connected in parallel and it last longer depending on the number of batteries and the ampere hour rating (AH) of the batteries

The battery used for this project is a rechargeable battery with the following rating:

12V (lithium ion battery)

Ampere hour rating = 5AH

Battery power = P_B = AH (ampere hour) --------------- (3.5)

Power. P=IV------------------- (3.6) by Humphreys

Where P= load power

$I = {}^{P}/_{V}$

$P_B = \frac{P.H}{t}$

$P_B = \frac{PY}{V}$

$t = \frac{P_B V}{P}$

Where. V = voltage

P = power demanded by load.

T = time in hour

P_B = battery ampere hour.

$t = \frac{5 \times 12}{80} = 0.75 hrs$

t= 0.75hrs × 60

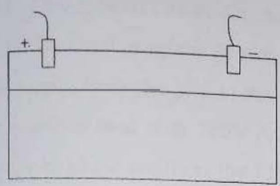
= 45min

Assuming losses in the circuit

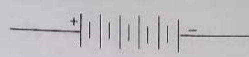
$t = \cong 50min.$

This time can be increase by using battery of higher Ampere hour rating and using more than one battery.

The battery is shown below.



(a) Schematic diagram of 12V rechargeable battery



(b) Circuit diagram 12V rechargeable battery

3.3 The inverter unit:

The inverter unit is the unit that converts the 12dc voltage to ac voltage the circuit diagram of the inverting unit is drawn below.

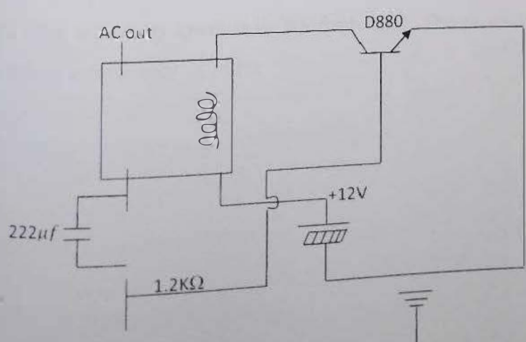


Fig. 3.5

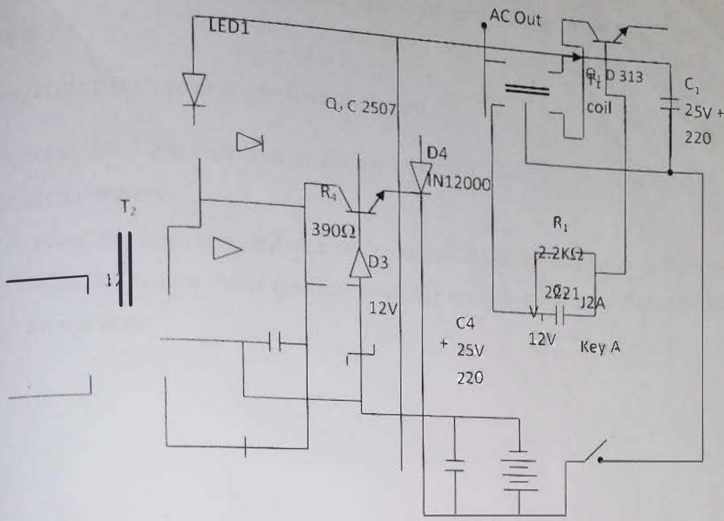
Principles of operation of rechargeable lamp using energy

The operation of the system is substantially as follows. Rechargeable lamp using energy bulb consists of the AC mains supply unit, charging unit, battery unit, inverting unit.

These unit are connected together to form the system respectively.

Fig 3.6 is the general circuit diagram of the rechargeable lamp. It is the direct coupling of each unit that makes up the system. Switch (switch1) connects the AC mains 220V 50Hz power supply from the grid to the circuit. When the switch is closed, the transformer T, primary coil is feed with 220V AC which gives 12VAC at the secondary. The rectifier full wave bi-phase rectifiers the 12VAC to give a pulsating DC12V which is then filtered by the capacitor. The LED_1 light up to indicates battery charging and power supply from grid. The 12V charges the battery.

When the transistor conduct at a cut-off point due to the voltage drop across the base will drop below threshold of the transistor the transistor will be off, the transformer will oppose the change of current flowing through it which results in change of magnetic field in the transformer. The action will result in a production of pulse voltage in the winding of transformer. the mica capacitor 222T will allow the pulse current to flow through it two the base of the transistor, the transistor will switch ON again and voltage across it's base will drop lower than the fresh hold. The process will continue and the circuit works at a frequency of 50Hz



3.4 Construction procedures:

Step1 The complete system was first connected on the bread to ensure that it works properly. The assembly is then transferred to the overboard. The arrangement of component on the electric board

Step 2 Other components were selected and checked and tested differently before their assemblage on a breadboard. The assembly was in stages according to the units. A success in each unit gave way to the subsequent one until all the stages result were gotten; heat sink was uses to fix the MOSFECTs.

3.5 Coupling

There was nothing at the output since a digital meter was at this stage used as a measuring instrument. A re-checks was done, this time an open-circuit was sported and corrected. The device was powered again. The voltage scale of the meter read 250V AC.

This good result opened the chapter for the final part of the project Soldering and packaging.

1. Connect the transformer to the inverter board.

2. Connect switch,2 pin wire to transformer input, FL

3. Connect the battery

Both were carefully done, especially the soldering which was carried out on a Vero board with a good soldering iron. After the final assembly inside a cased box of quality plastic another test was done.

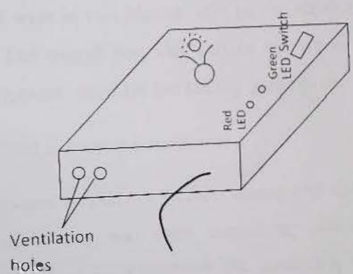


Fig 3.7 package diagram of the system

CHAPTER FOUR

Constructional Analysis

The chapter deals. mainly with testing of the system performance. evaluation. displaying the assembled components as mounted on the Vero board according to the circuitry designed.

The testing of each component. sub-units and the entire system after assembling was mentioned

Performance Evaluation

In order to assess the performance of the rechargeable lamp using energy bulb. some measurements were considered from each of the system.

The tests conducted were in two phases: one on the electrical components and the other after connecting it. The overall test was carried out when the system was finally coupled together. The equipments used for the testing include: digital multi-meter.

Testing (continuity test and short circuit test)

Various tests short were carried out before. during and the construction had been completed the digital multi-meter was used extensively during the implementation process and testing stages. It was used to check the continuity of some components to make sure the two lines do not touch (short circuit) test due to improper connection. The millimeter was employed at different level of troubled shooting. The test carried out are: continuity tests. components test and resistance test etc.

The system was plug to the 13A socket outlet. and then switches ON. It was left for 45minutes. when disconnected from the 13A socket the power source was not longer from the mains supply but from the battery which gave an output that powered the energy bulb used in the system

Table 4.1 Test Result

S/No	Quantities	Obtained result
1	Output voltage	220V
2	Output power	110watt
3	Frequency	50HZ
4	current	4000mAh

Table 4.2: Cost Evaluation

S/No	Component	Type	Rating	Unit	Cost ₦	total ₦
1	Transformer		220/12v	1	500	500
2	Transistor	MOSFET		2	400	400
3	Diodes			4	40	40
4	LED			2	100	100
5	Resistor		1KΩ	2	40	40
6	Resistor		22KΩ	3	90	90
7	Resistor		12KΩ	1	20	20
8	Capacitor		$47\mu f$	2	100	100
9	Capacitor		$1\ \mu f$	1	50	50
10	Coil			1	400	400
11	Switch			1	50	50
12	Heat sink			2	200	200
13	Plug wire			1	50	50
14	Rechargeable	Li-ion	12V	6	3000	3000
15	Jumper			1	50	50
16	Soldering			1	50	50
17	Plastic casing			1	1000	1000
18	Lamp holder			1	100	100
19	Energy		25w	1	80	80
20	Miscellaneous				500	500
					Grand total	6,820

CHAPTER FIVE (5)

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMERY

This project report has been prepared to reflect the work carried out from conception to implementation. The never ending drive towards smaller, lightly efficient and high capacity electronic power supply necessitated the design and construction of rechargeable lamp using energy bulb. The system consist bank of batteries which charges and store charges when there is utility power supply while it discharges at the time of utility power outage to provide output capable of powering energy bulb.

CONCLUSION

The design and construction of a rechargeable lamp using energy bulb was achieved in this project through the use of low cost components which are readily available in the market. The idea was to avoid a robust and cost effective rechargeable lantern.

RECOMMENDATION

In the course of this research works, several factors and challenges have been encountered which should be taken into careful consideration when modifying the design for enhanced performance.

These include:

Adequate protection against voltage surge and spikes should be incorporated in the design to avoid frequent damage of sensitive components like MOSFETS

The battery could be replaced with higher rated battery to increase the duration of un-energized operation. And also it is recommended that the project works should be given on time to the students so as to have enough time for research and construction of the system.

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