DESIGN, CONSTRUCTION AND TESTING OF AN EMERGENCY LIGHTING SYSTEM

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DECLARATION

I hereby declare that, this thesis presented in partial fulfilment of the requirement for the award of Bachelor degree in Electrical and Computer Engineering (B.Eng) is a complete handwork of BAKABE MAMAN SIRADJI 96/5661EE under the supervision of Mr. Jedna during 1999/2000 academic session.

CERTIFICATION

I hereby certify that I have supervised and approved this project work which I found to be adequate in scope and qualify for the partial fulfilment of the award of a Bachelor degree in Electrical and Computer Engineering (B.Eng.)

SIGN:______________________ DATE:__________________

PROJECT SUPERVISOR

SIGN______________________ DATE__________________

HEAD OF THE DEPARTMENT

SIGN______________________ DATE 17/1/01

EXTERNAL EXAMINER

DEDICATION

This project work is dedicated to my father Alhaji BAKABE MADI died on July, 3rd 1987 and to my mother HAJIYA AMORE HAMMOU.

ACKNOWLEDGEMENT

My gratefulness goes to Almighty Allah whose infinite mercy, love and providence guided me through this programme.

My sincere appreciation goes to BAKABE family for their financial and moral support.

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My indebtedness goes to Eng. FRIDAY, Managing Director of HARDWARE DATA SYSTEM, and LAWANI PRECIOUS F.U.T. Minna who have in one way or the other make this project a huge success.

I also express my unalloyed and earnest gratitude to all NIGER REPUBLIC students of FUT Minna and relatives both near and far who serve as pipeline to make this project see the light of the day.

Lastly, another big thank to Mr. JEDNA, my able and worthy supervisor for his immensed contributions that make this project a huge success. Also his kind understanding and advice are appreciated.

ABSTRACT

Light is very important in the human life. So the wish of every nation is, to have a constant power supply.

The objective of this project, titled design, construction and testing of an emergency lighting system, is to solve the problem of power outages. It is also a response to the need of constant power supply recommended by people where domestic power outages is very constant. The emergency lighting system can be used in special places like libraries, hospitals, Hotels, Bank vault and sensitive locations like theatre room, stadium, public corridor etc.

The system was designed using rechargeable battery and a standby power source to keep the battery on full charged.

The beauty of the project is that it is self-rechargeable. The system is fully automatic, turning ON a few seconds after a.c power supply goes off and turning OFF as soon as power supply is restored.

Indeed it is gratifying to note that instead of using energy consuming by higher output power fluorescent lamp is used.

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CHAPTER ONE

1.1 INTRODUCTION AND LITERATURE REVIEW

1.2 INTRODUCTION:

The design and construction of an emergency lighting system was made to solve the permanent problem of commercial power supply failure.

It is also a response to the wish for constant power supply that is recommended by people where power outages are very common.

The emergency lighting system is supplying light when the commercial power supply is off. And when the commercial power supply is on, the system operates under the battery charger mode.

In order to make life a little easier, premises licenses must be pruned to have some form of secondary lighting as emergency system. This could be used in places like Hospitals, liberies lecture theatre, Bank vault etc.

There are different types of emergency lighting system; of which are:

a) Standby power source:

It consists of a battery charger used to keep the battery on full charge, a battery connected to a dc to ac inverter; an inverter circuit which aim is to provide ac power for the sensitive load through a switch.

b) Solid State system

This emergency lighting system has a general configuration like that of the standby power source. The exception is that the sensitive load operates continually from the output of the static inverter. A commercial power line, known as bypass is provided around the power source through a switch. This scheme is known as an on-line emergency lighting system.

c) Rotary power source

This consists of a battery driven dc motor that is mechanically connected to an ac generator. The battery is kept in a charged mode by a battery charger, like for the standby power source.

This project is based on the standby power source. This is the most convenient and has economical source of power. It has more advantages and uses a simplified circuit. The fluorescent lamp was chosen since it:

- Provides adequate illumination
- Avoids glare and hard shadows
- Provides sufficiently uniform distribution of light all over the working plane.

The system is also using an automatic switching device known as "Relay" and a red and green LED to show the different mode of operation of the system. The system takes its supply from the commercial power supply.

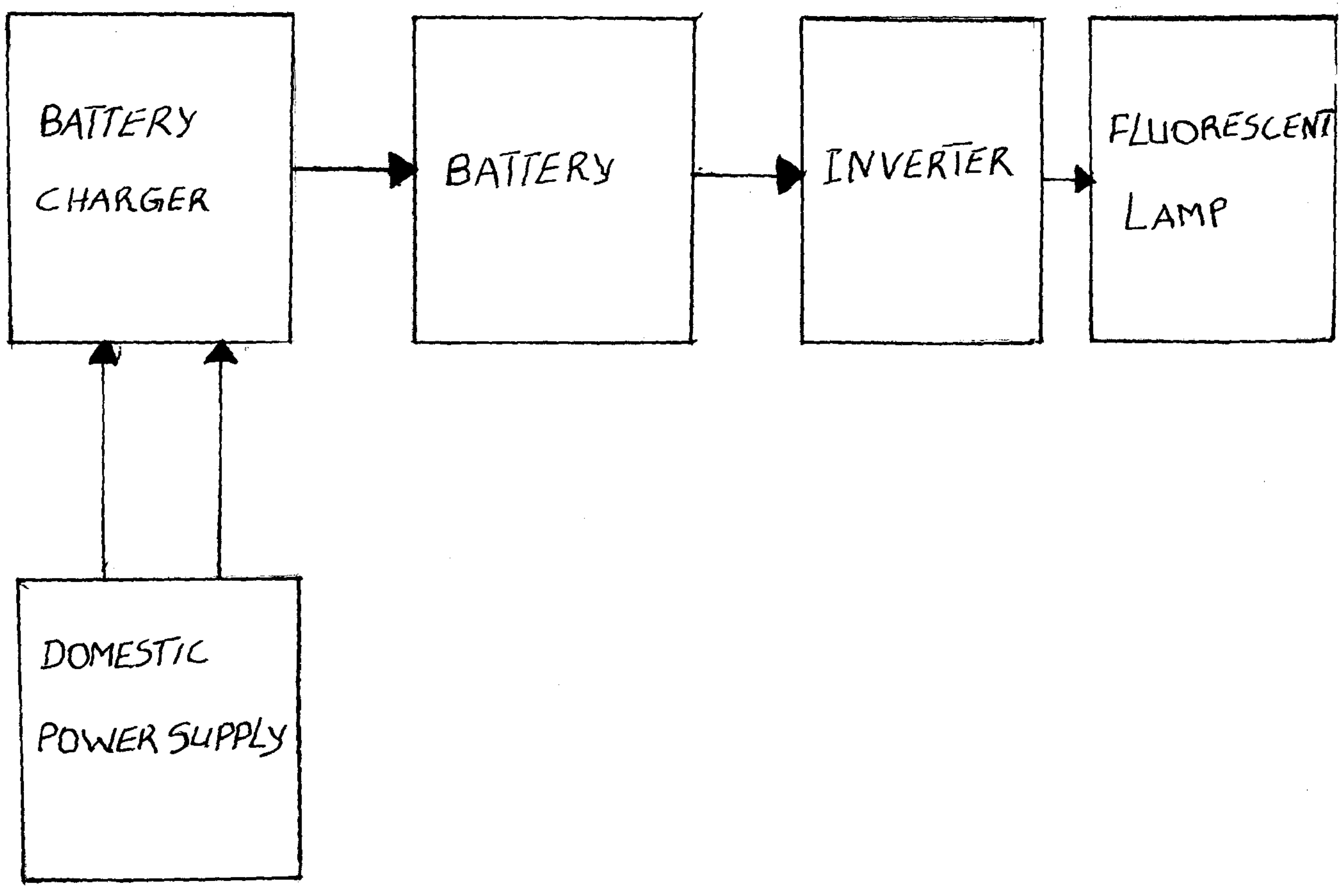

Fig 1.1. Basic Block Diagram of an emergency lighting system

Battery Charger:

The purpose of the battery charges is to keep the battery on full charge.

Battery:

The battery is used to provide dc power to the inverter cricuit anytime the commercial power supply is removed.

Inverter:

The aim of the inverter cricuit is to change back the dc power received from battery to an ac voltage in order to power the fluorescent lamp. The inverter determines the quality of power used to drive the load. It is the most important subsystem of the emergency lighting system.

1.3 **LITERATURE REVIEW**

Naturaly the lighting system consists of noon light and moon light. Between these there is a gap of darkness. The importance of light in human life gives rise to producing artificial light. The usual method of producing artificial light, involves raising the temperature of a solid body or vapour to incandescence by applying heat to it. It is found that as the body is gradually heated it begins to radiate energy and finally becomes luminous.

During the last few decades, different artificial sources of light are produced. So the different methods of producing light by electricity may in a broad sense, be divided into three groups:

i) By temperature incandescence

ii) By establishing an arc between two carbon electrode. The sources of light in this case is the incandescent electrode

iii) Discharge lamps ie. Mercury vapour lamp, sodium vapour lamp, neon-gas lamp and fluorescent lamps.

Nowadays improvements are made which give rise to some form of emergency lighting system of which are:

i) Solid state system

ii) Rotory power source

iii) Standby power source

This project is based on a standby power source. The system takes it supply from the domestic ac power supply, and it is basically made of a battery charger, a battery; an inverter and fluorescent lamp.

Each block is fully explained in chapter two.

In short, chapter one reviews all about the project. i.e introduction and literature review.

Chapter two explains the theories and design followed for the construction of the system.

Chapter three is based on the construction, testing and results. And finally chapter four gives the conclusion and offer some recommendations and references.

CHAPTER TWO

2.1 SYSTEM THEORY AND DESIGN

2.2 SYSTEM THEORY

The design of the emergency lighting system is mainly based on two parts.

i. BATTERY CHARGER UNIT

ii. INVERTER UNIT

The battery charger is used to keep the battery that is supplying the inverter unit, on full charged.

The inverter unit is used to change back dc power into ac power (just the opposite of converter

An automatic switching device known as "relay" is used to select these two modes.

2.3 BATTERY CHARGER UNIT.

A battery charger is an electrical device that is used for putting the power energy into a battery. The battery charger changes the a.c received from the power line into dc, suitable for charger.

In general, a mains operated charger conscits of the following elements.

The transformation unit which consist of

i. A step - down transformer for reducing the high ac mains voltage to a low ac voltage.

A Rectification unit consisting of

ii. A half wave or full-wave rectifier for converting alternating current into direct current.

iii. A charge - current limiting element for preventing the flow of excessive charging current into the battery under charge.

iv. 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.

In addition to the above, a battery charger may also have circuitry to monitor the battery voltage and automatically adjust the charging current. It may also terminate the charging process when the battery becomes fully charged.

However, in many cases, the charging process is not totally terminated but only the charging rate is reduced so as to keep the battery on trickle charging.

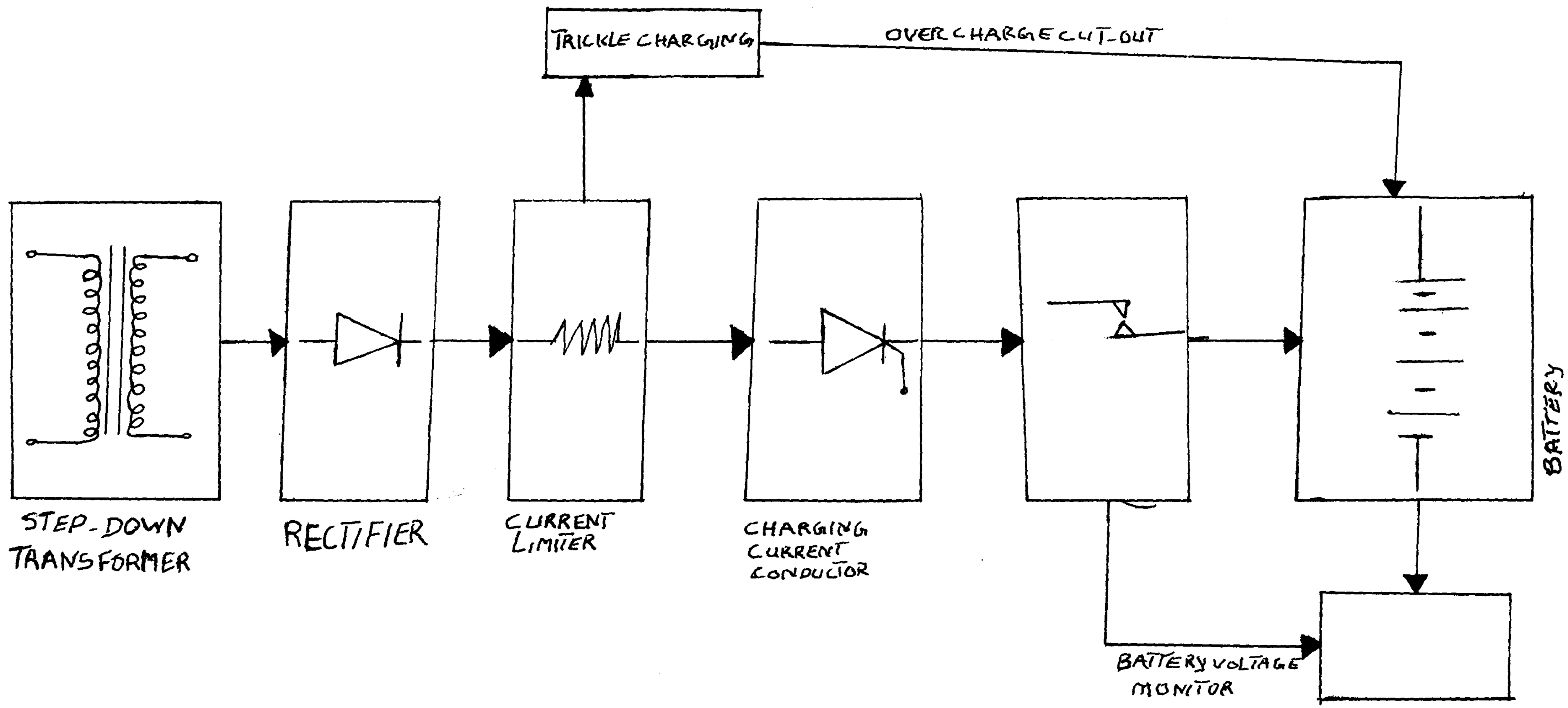

Fig 2.1 Basic Block diagram of a battery charger

2.3. TRANSFORMER STAGE

A transformer is a static (or stationary) piece of apparatus by means of which electric power in one circuit is transformed into electric power of the same frequency in another circuit. It can raise (step-up) or lower (step down) the voltage in a circuit but with a corresponding decrease or increase in current.

i. ELEMENTARY THEORY OF AN IDEAL TRANSFORMER

An ideal transformer is one which has no losses i.e. its windings have no Ohmic resistance, there is no magnetic leakage and hence which has no I^2R and core losses. In other words, an ideal transformer consists of two purely inductive coils wound on a loss free core. It may however be noted that it is impossible to realize such a transformer in practice.

In an ideal transformer on no-load,

$V_1 = E_1$ and $E_2 = V_2$

Where V_1 is the primary voltage

V_2 is the secondary voltage

E_1 is the emf induced in primary

E_2 is the emf induced in secondary

(V_1, V_2, E_1, E_2 are rms value)

The voltage transformation ratio $K = E_2/E_1 = N_2/N_1$

if $N_2 > N_1$ i.e. $K > 1$ then transformer is called

step-up transformer

if $N_2 < N_1$ ie. $K < 1$ then transformer is called

Step - down transformer

$V_1 I_1 = V_2 I_2$ or $I_2/I_1 = V_1/V_2 = I/k$

2.5 RECTIFICATION

Most of the electronic devices and circuits require a dc source for their operation. Since the most convenient and economical source of power is the domestic ac supply, it is advantageous to convert this ac to dc voltage. This process is known as rectification. It is accomplished with the help of:

i. Rectifier

ii. Filter

iii. Voltage regulator circuit.

i. **Rectifier**

It is a circuit which employs one or more diode to convert ac voltage into pulsating dc voltage.

The technics used are mainly:

- Half - wave rectifier
- Full-wave rectifier
- Full-wave bridge rectifier

Half wave rectifier

For a half wave rectifier a single diode is used (a diode is a semiconductor device which allows a current flow in one direction).

Only one half-cycle of the input wave is used.

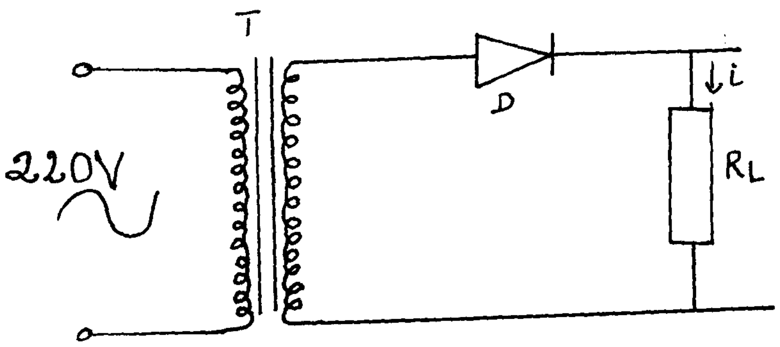

Fig. 2.2a Half wave rectifier circuit

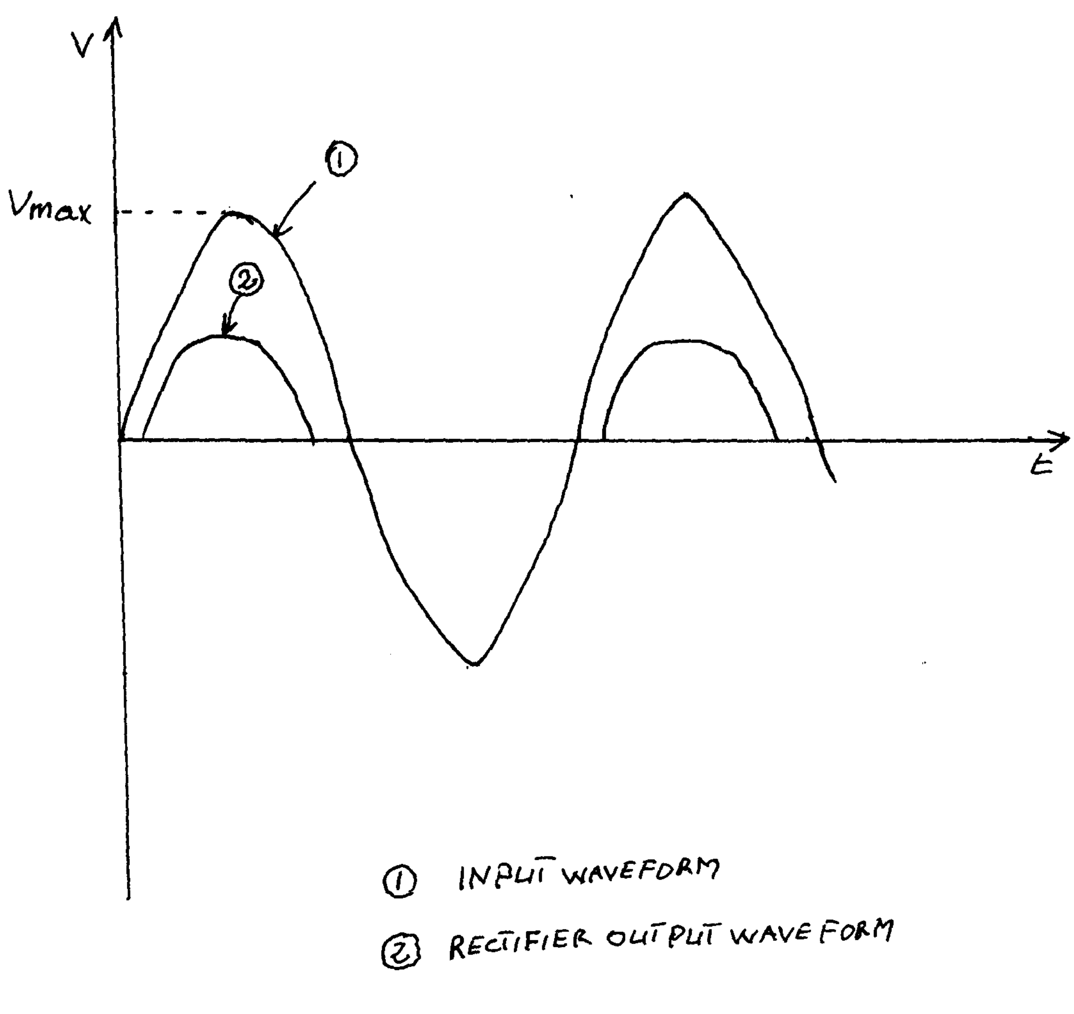

Fig. 2.2b Input and output wave form

FULL-WAVE RECTIFIER

For a full-wave rectifier both half cycle of the input wave are used. The circuit is using two diodes and a center tap transformer. The two diodes are working alternatively.

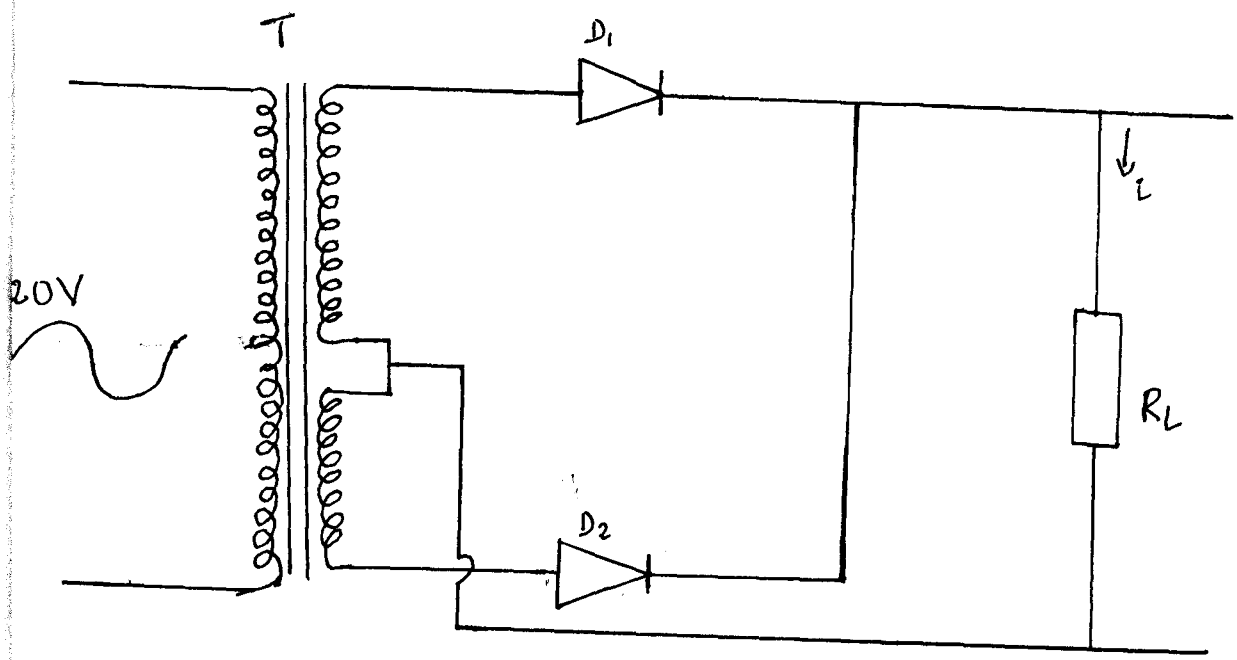

Fig 2.3a Full wave rectifier circuit

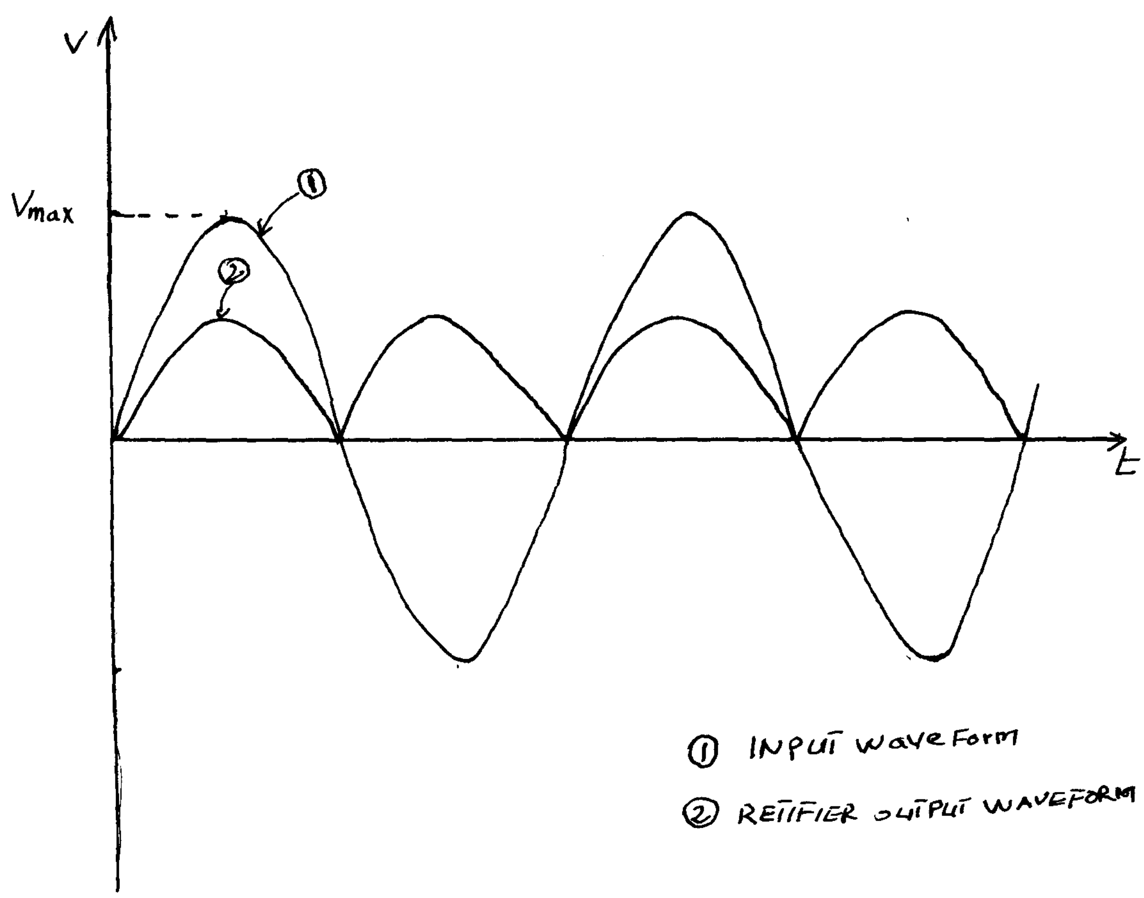

Fig. 2.3b Input and output wave form

FULL WAVE BRIDGE RECTIFIER

The full wave bridge rectifier is used in this project. It requires four diodes but the transformer used is not counter-tapped.

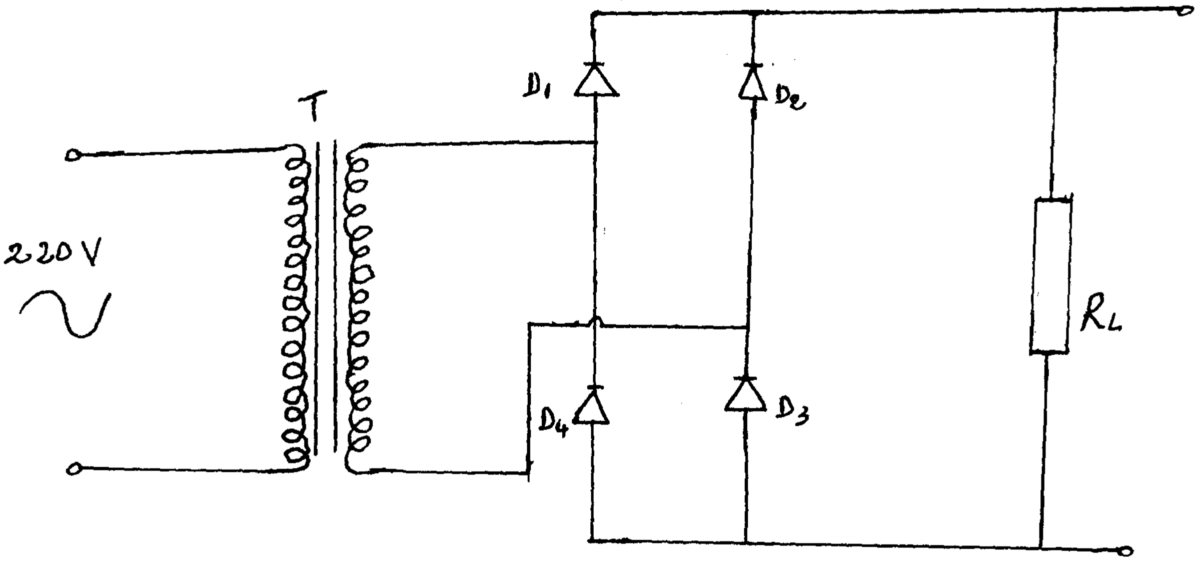

Fig 2.4 Full wave Bridge rectifier circuit

2.6 BATTERY CHARGING

The output from the full wave bridge rectifier is fed into the battery charger circuit.

The battery charger circuit is using silicon controlled rectifier (SCR).

The SCR is one of the prominent members of the thysistor family. It is a four-layer or PNPN device. Basically, it is a rectifier with a control element. It is widely used as a switching device in power control application. It can control loads by switching current off and on up to many thousand times a second. It can switch on for variable lengths of time, thereby delivering selected amount of power to the load.

Usually, SCR is operated with an anode voltage slightly less than the forward breakover voltage V/BO and is triggered into conduction by a low power gate pulse.

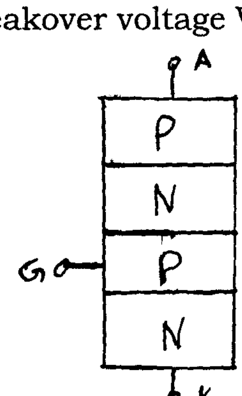

Fig 2.5a SCR Structure

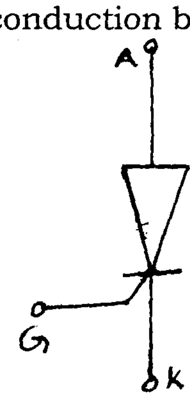

Fig. 2.5b SCR Symbol

OPERATION

The rectified voltage from the full wave bridge rectifier is divided through the resistors R_1 and R_2 which serve as voltage divider. A small current flows through the diode D_1 and trigger the gate of thyristor R_{T1} which will start conducting. So current flowing through the anod-cathod of THI is ralied by the reosthat R_{T1} to have a constant charging current for the battery. This is called charging Current.

The maximum charging voltage is chosen by varying the reosthat RTHII. When the battery voltage exceed the chosen value, the excess current flow R_{T2}through D_Z and trigger T_{H2}.

Thyristor T_{H2} will start conducting and stop T_{HI} by grounding the voltage of T_{HI}. The charging process is then stopped.

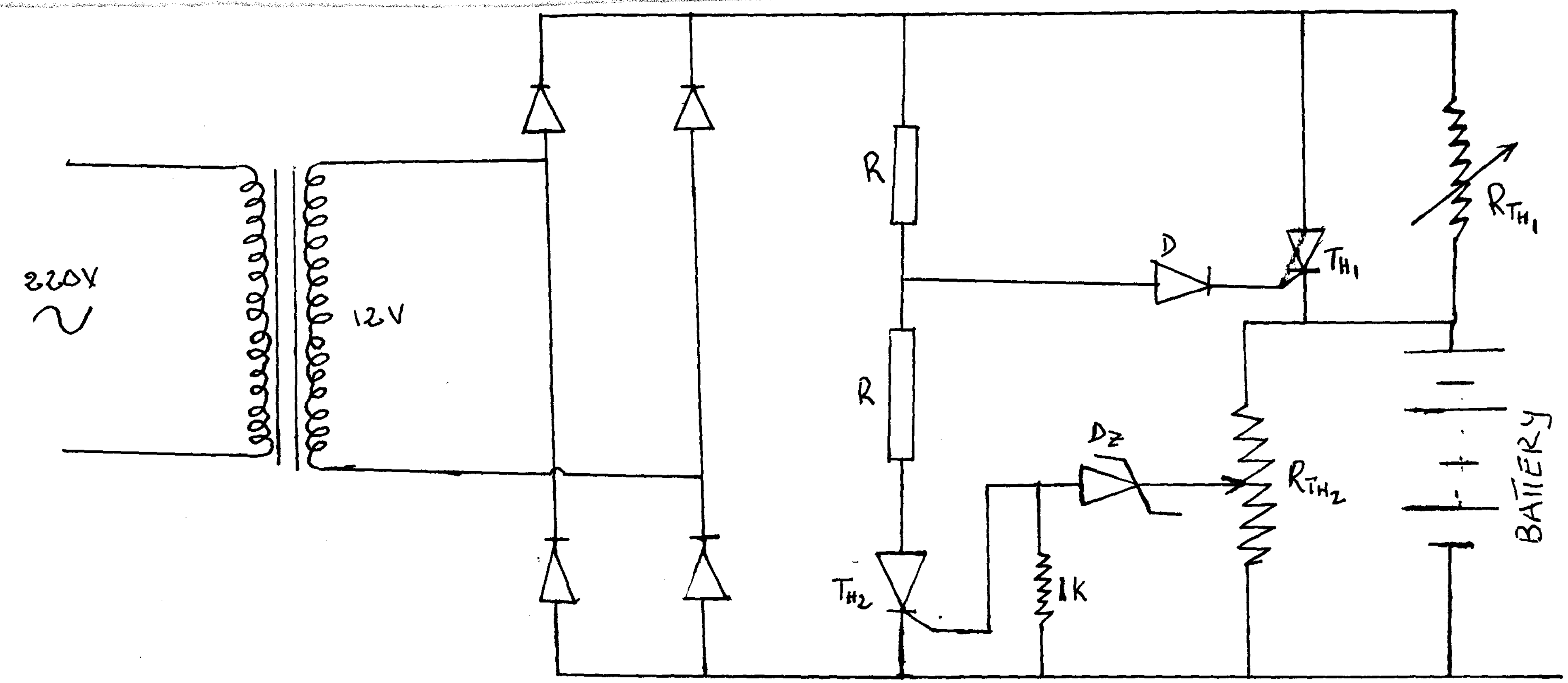

FIG. 2.6 BATTERY CHARGER CIRCUIT

2.7 **BATTERIES**

An electric battery consists of a number of electro-chemical cells, connected either in series or parallel. A cell, which is the basic unit of a battery may be defined as a power generating device, which is capable of converting stored chemical energy into electric energy.

If the stored energy is unherently present in the chemical substances, it is called a primary cell or a non-reachargeable cell. The battery made of these cells is called primary battery.

If, on the other hand, energy is induced in the chemical substances by applying an external source it is called a secondary cell or rechargeable cell. A battery made out of these cells is called secondary battery or rechargeable battery.

For this project we use a rechargeable battery. There are various types of secondary batteries which can be grouped into:

(i) Automotive batteries

(ii) Vehicle traction batteries

(iii) Stationary batteries.

Among these groups we choose a standby power system which is a stationary battery and is used intermittently. It is also easy to find because it applications have increased in recent years with increasing demand for uninterruptable power systems (Ups).

This battery is used to provide emergency lighting in case of domestic power outages.

2.8 **INVERTER UNIT:**

An inverter is a device that changes dc power in to ac power (just the opposite of converters). This inversion can be achieved with the help of transistors, SCR and tunned diodes etc.

For low and medium output, transistorised inverters are suitable but for high power output SCR inverters are essential. For very low voltage and high current requirement, tunned diode inverters are used.

For this project transistorised inverter is used because it has definite advantages over SCR, regarding the switching speed, simplicity of control circuitry, high efficiency and greater reliability.

2.9 LIGHTING UNIT.

The final expectation of this project is the emergency lighting. This unit is composed of only a fluonescent lamp. A starterless fluorescent lamp is chosen. It does not require the use of starter switch. And commercially it is known as "instant start" on "quick-start" fluorescent lamp. The advantages of this lamp are:

i. It is almost instantaneous starting
ii. There is no flickering and no false starts.
iii. It can start and operate at low voltage (160-180v)
iv. It has the best average working life (of 4000hours but of 1000 houses for incondescent lamps, 3000hours for sodium vapour lamps).

2.10 SWITCHING DEVICE

A switching device is used in this project. It's aim is to switch automatically ON OR OFF the inverter unit when the domestic power supply fails or when it is reinstalled.

This switching device is known as "Relay".

A relay is an electrical switch that can be operated either magnetically or electromagnetically.

The most common types are electromagnetically operated.

A control current from the bridge retifier flows through a coil of wire which thus behaves as an electromagnet. “A soft” iron amature is attracted by the established magnetic field and this, inturn causes a contact to be made or broken depending on the relay design.

Where the relay is energized it switches OFF the inverter unit and when it is de-energized it switches ON the inverter unit.

2.11 INDICATORS

Light emitting diodes, (LED) are chosen as indicator. A LED is a forward biased PN junction when emits visible light which energised

The red light showed by the LED indicates the battery charging mode or the stand by mode.

The green light shows the emergency lighting mode.

CHAPTER THREE

3.1 **SYSTEM ANALYSIS AND CONSTRUCTION**

3.2 **SYSTEM ANALYSIS**

The emergency lighting system is made up of two main parts namely:

- The battery charger
- And the inverter circuit

3.2a **CALCULATION OF THE BATTERY CHARGER UNIT**

A step - down transformer used is 220v/12V

$Vs/Vp = N2/N1 = 12/220 = 0.05$

The transformer turn ration $N2/N1 = 0.05$

The output of the step - down transformer was rectified using full wave bidge rectifier, with IN4007 diodes.

Since $Vm = Vrms\sqrt{2} = Vs\sqrt{2} = 12V \times \sqrt{2} = 17V$

Then $Vdc = 2Vm/II = 2 \times 17/3.14 = 10.8V$

A light Emitting Diode (LED) was also used which voltage and current ranges are respectively $V_{LED} < 3V$ and $I_{LED} < 20mA$

So taking $V_{LED} = 2.5V$ and $I_{LED} = 8.mA$

Then the resistor connected in series with the LED is

$vdc = V_{LED} + V_R = 10.8V \Rightarrow V_R + 2.5V = 10.8V$

$V_R = 10.8 - 2.5 = 8.3V$

$V_R = I_{LED} \times R \Rightarrow R = V_R/I_{LED}$ $8.3v/8.3mA =$ $1000 = 1KILO$

- The resistor R2 and R3 are used as pottential divider

Idc is of 1.5A from 1N4007 diodes

$V_{R2} = V_{R3} = R_2/R_2 + R_3\ Vdc = R/2R\ Vdc = Vdc/2 = 10.8/2 = 5.4V$

The current that can trigger the gate of the theysistor

T1 is $I = 0.115A > TH$ (holding current = 3mA)

$R2 = 5.4V/0.115A = 46.95n = R3$

- The series resistors R4 and R5 are used as current limitter. It limits the charging current. The battery max-charging current is of 1.35A. Taken charging current of 1.25A

The T1 anod current is of 1.27A

So R4, R5 current is 1.27 - 1.25 = 0.02A

Vdc/0.02 = 10.8/0.02 = 540.2

We choose R_4 of 250 fixed resistor and ac variable resistor R4 of 250

- The series resistors R6 and R_7 are used to stop the charging process.

When the battery is fully charged the excess current flow through R_6, R_7 and trigger the gate of T2. Let I = 8.5mA. R_6, R_7 = $6V/8.5 \times 10^{-3}$ = 705.3

We choose R6 of 270 (fixed)

and R_7 of 470 (variable)

When the battery is pully charged Vb > 6V

Vb > V_z so the zener diode will start conducting and the excess voltage drop accross R_8 = Ik

The thyristor T2 is triggered and off the thyristor T_1

3.2b **INVERTER CIRCUIT CALCULATION**

The battery used is a rechargeable battery of 6V

Vb = 6V

Is = 13.9mA

For the LED voltage of 2.5V

LED current of 3.5mA

The resistor that can protect the LED should be:

Vb = V_{LED} + VR => VR = Vb - V_{LED}

VR = 6-2.5 = 3.5V

VR - R9 x L_{LED} => R9 = VR/L_{LED}

R9 = 3.5 = 1000

3.5 x 10-3

R9 = 1k.

When the switch is ON the 10UF capacitor is charged. When it reaches Vb = 6V it discharges in R10.

The same 6V drop accross R10 so

VR = R10 X 1S = 6V

R10 = VR/IS = $6V/13.9X10^{-3}$

R10 = 430

The common emitter connection of the transistor TIP 41 produce 180° phase shift and the transformer also give 180° phase shit, making a total of 360° phase shift. Under this condition oscillation can take place. This is known as "BARKHAUSEN CONDITION"

Since the transistor TIP41 operates on a signal frequency of about 5.5HZ

We choose C_1 and C_2 to be ceramic capacitors which frequency range is of 1KHZ to 200MHE

ZC = $1/2\pi FC$

(taken 5% error) Zc < 5/100 R => C< 100/5x2x3.14 x FR

C < $100/5 \times 2 \times \pi FR$

For F = 5.5KHZ R = 430

$$C < \frac{100}{5 \times 2 \times 3.14 \times 5.5. \times 10^3 \times 430}$$

C < 1.3 UF

For F = 200MHZ

$$C < \frac{100}{5 \times 2 \times \pi \times FR}$$

$$C < \frac{100}{5 \times 2 \times 3.14 \times 200 \times 10^6 \times 130}$$

C < 3.7PF

We can choose 3.7PF < C < 1.3 UF

C1 = 223k = 22×10^3 PF = 0.022UF

C2 = 203k = 20×10^3 PF = 0.020UF

3.3 **CONSTRUCTION**

This chapter showed also the different procedure followed for the constrcution of the emergency lighting system. Many assumption are taken in account for the theory and design of each part of the system.

The circuit was first constructed on a bread board and the transferred on the verroboard with careful soldering of components.

All components were well soldered to avoid partial contact and possible short circuit.

The principle part of the system constructed are namely:

1. The main power supply
ii. The battery charger
iii. The switching control
iv. The inverter
v. The indicator
vi. The lighting unit.

3.4 **THE MAIN POWER SUPPLY**

The system has a standard by power source, which is getting the supply from the domestic power source (NEPA). The received power (220Vrms) is stepped down by mean of a transformer (220/12v). The 12V out of the transformer was rectified via a full- wave bridge rectifier using 1N4007 diodes.

Thus a d.c voltage was obtained to power the battery charger unit.

The step-down transformer (220v/12v) has a turn retio of:

$Vs/VP = N2/N1 = 12/220 = 0.05$

The full-wave bridge rectifier using 1N4007 diodes gave a dc output of:

$Vm = Vrms\sqrt{2} = Vs\sqrt{2}$

$Vm = 12 \times \sqrt{2} = 16.97 = 17V$

$Vdc = 2Vm/\pi = 2 \times 17/3.14 = 10.8V$

3.5 **BATTERY CHARGER**

In order to keep our stationary battery on fully charged a charger circuitry was made.

The battery charger is using silicon controlled rectifier (SCR). The thysistor C106Y was used for this purpose, it controls the charging effect of the battery.

The resistors R1 and R2 are of the same value (47) and were connected in paralled. There are used as voltage divider.

The diode D1 was connected to the gate of the SCRI, to trigger the gate when the battery is charging.

The anod of SCR, was connected to the positive potential of the supply and the cathod connected to the positive potential of the battery.

The reosthat RT1 was connected in parrelled with the SCR1 to limit the charging Current.

The reosthat RT2 was connected in parallel with the battery to limit the charging process.

The zener diode D2 was connected to the reosthat RT2 and the gate of SCR2 to trigger the gate and stop the charging process.

3.6 **SWITCHING CONTROL UNIT**

The received power from the domestic source was rectified through the main power supply. At the output of the bridge rectifier an automatic switching device was connected. When the current flow through the relay, it is eneigized and a magnetic field is set up which magnetise the coil terminal and current flows into the lead acid battery through the battery charger. When the power supply fails the relay is de-energized and thereby change over to the emergency lamp. The battery which was charging before now supply the current to the fluorescent lamp through the inverter unit.

The relay provides safety for the operation of a device or a system.

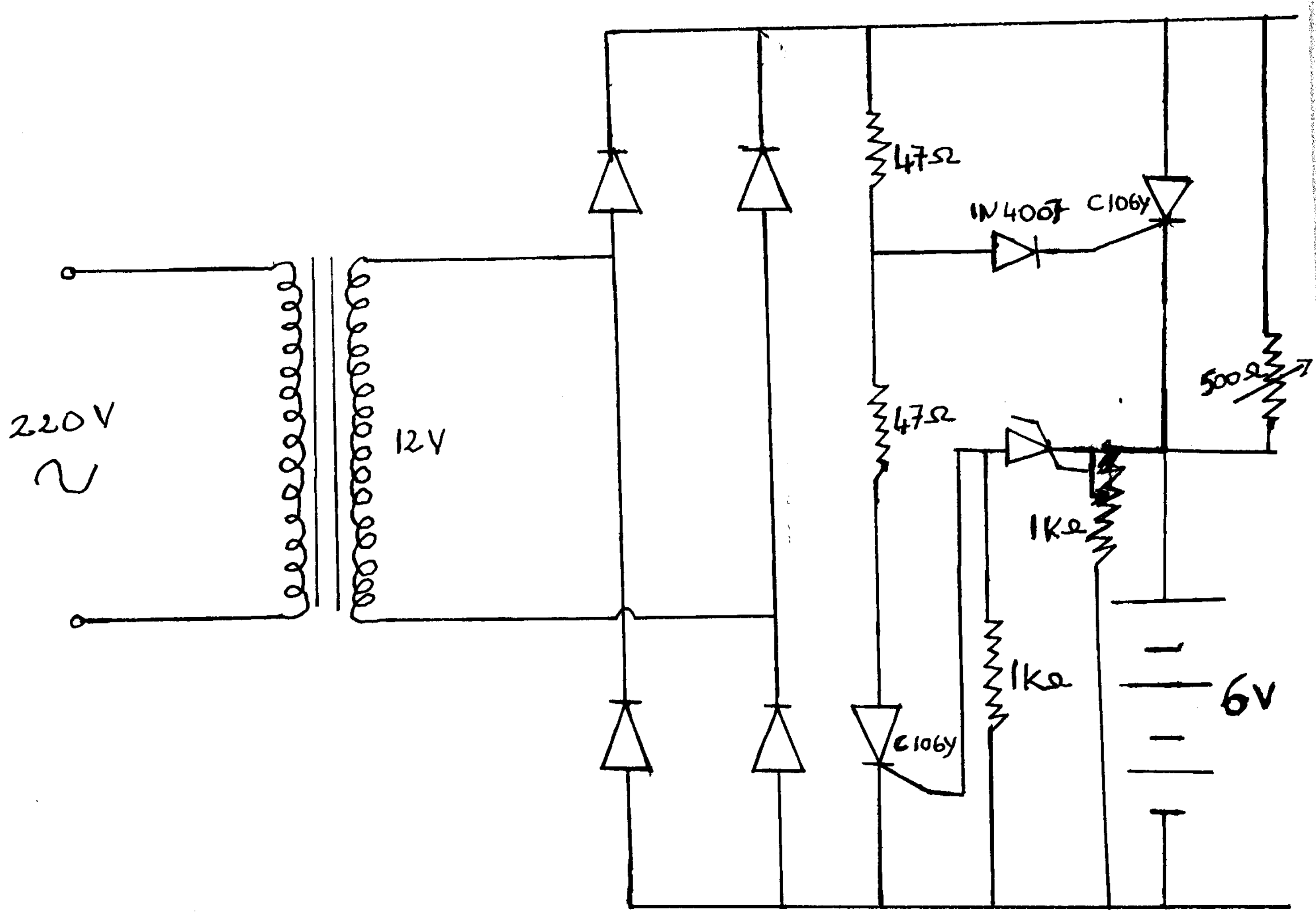

FIG. 3.1 BATTERY CHARGER CIRCUIT

3.7 **THE INVERTER UNIT**

The inverter unit is the most important part of the system. It takes its supply from the stationary battery.

$Vb = V6$

$I_S = 13.9mA$

When the relay is de-energized it switches ON the inverter circuit and current from the stationary battery flows to charge the capacitor C_1 which discharges to the resistor R.

The common emitter connection of thetransistor TIP 41 produces 180° phase shift, making a total of 360° phase shift. Thus the oscillation can take place according to "BARKHAUSEN CONDITION".

The base- emitter and base collector give cosine and sine wave forms which summation gives an equivalent sine wave form or the alternating output voltage which is amplified by the step-up transformer.

The output of the step-up transformer powers the fluorescent lamp.

3.8 **INDICATOR UNIT**

The connection of light emitting diode (LED) was made as indicator. The LED are connected in series with 1k resistor which serves as current regulator to the LED. The red LED indicates when main power supply is ON and the green LED indicates the emergency lighting mode.

3.9 **THE LIGHTING SYSTEM**

The objective of this project is to get an emergency lighting. Thus a fluorescent lamp was used at the output of the step-up transformer. A starterless fluorescent lamp was used to get an instantaneous lighting with a low ac voltage of 160 to 180V (rms value).

Both upper pins of the fluorescent lamp are jointed to the positive output of the step-up transformer and the two other pins jointed to the negative output of the step-up transformer. So when the inverter circuit is switched ON an instant illumination is obtained.

~~FIG. 3.2 INVERTER CIRCUIT~~

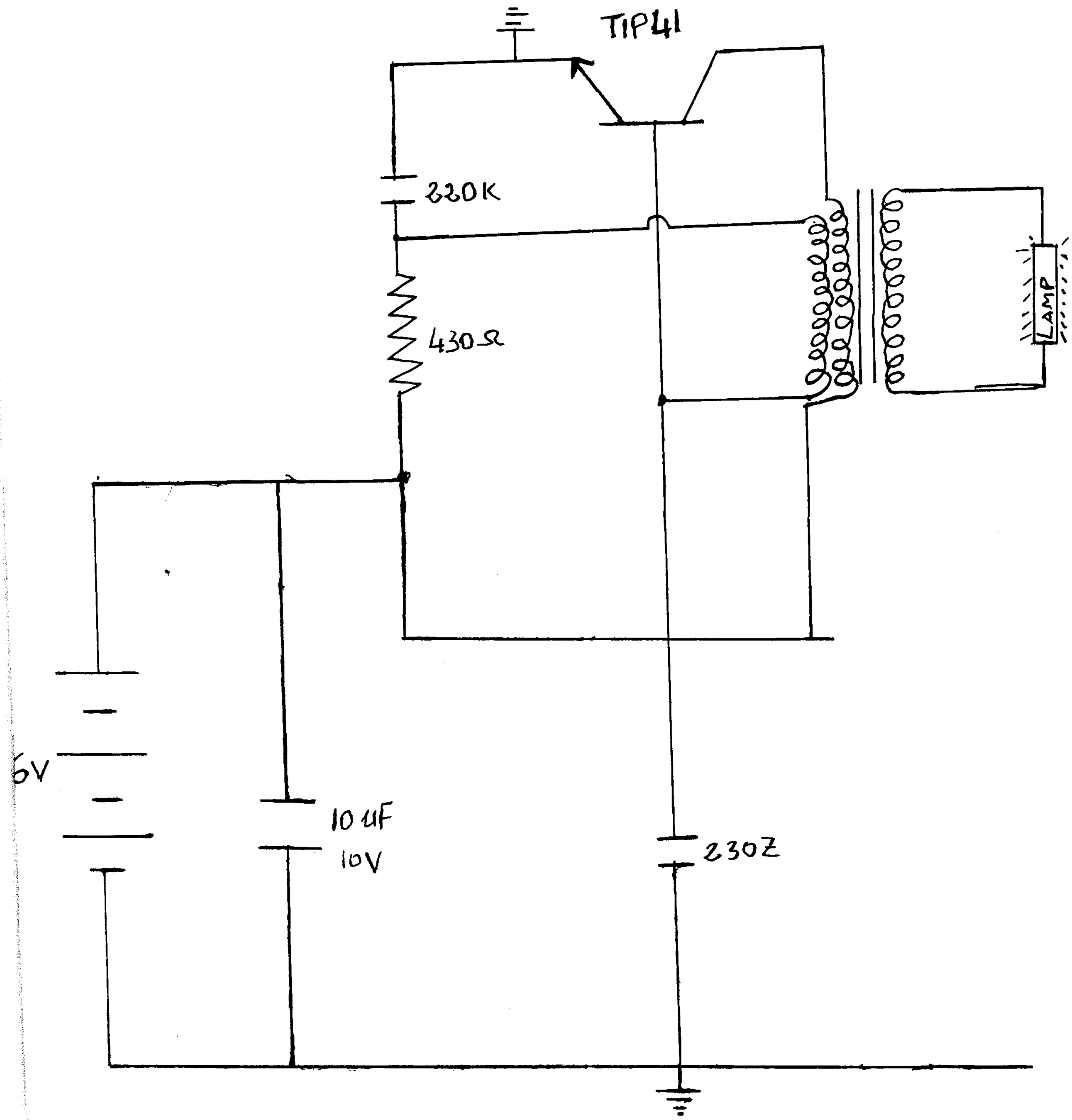

FIG 3.2 INVETER CIRCUIT

3.10 **TESTING.**

The components used for the construction of the emergency lighting system were all tested before soldered on to the verroboard.

Partial contact of pins and possible short circuit are avoided.

All connections on the circuit are carefully controlled.

The system device was plug to the main ac power supply, which serve as battery charging. later the power supply was removed such like power outage. The emergency lighting came up, proving the successful completion of the project construction.

Thus the aim of the project termed "DESIGN CONSTRUCTION AND TESTING OF AN EMERFGENCY LIGHTING SYSTEM" is then successfully achieved.

3.11 **DISCUSSION OF RESULT:**

The emergency lighting system analysis was made in previous chapter where the functional parts were enumerated.

The main power supply is connected to a step-down transformer. The output from the secondary was connected to full wave bridge rectifier circuit. The rectified ac voltage was connected to the relay which serves as switching device.

The positive and negative polarity of the rectifier circuit were connected to a 6v lead acid battery to insure the constant current charging.

The indicator also receives its supply by connecting the anode to positive polarity coming from the rectifier circuit and the cathode connected to 1K resistor which serves as diode protector.

The negative terminal of the battery is connected to the negative end of the inverter circuit. And the other terminal of the inverter is connected to the positive end of a relay.

The inverter circuit converts the direct current coming from teh 6v battery to ac. The amplification of the ac voltage by the step-up transformer, power the fluorescent lamp. And tested positively by the illimination

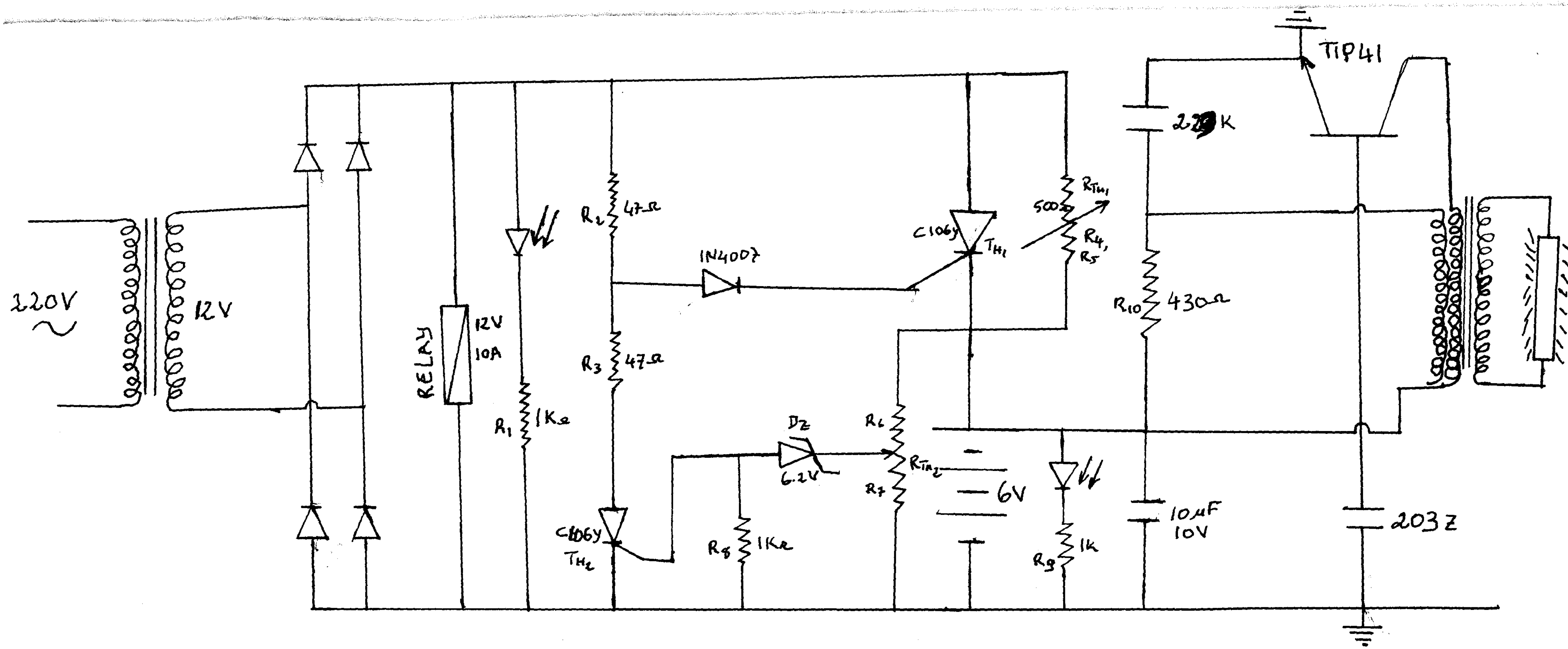

FIG. 3.3 EMERGENCY LIGHTING SYSTEM CIRCUITRY

CHAPTER FOUR

4.1 CONCLUSION RECOMMENDATION AND REFERENCES

4.2 CONCLUSION:

The design construction and testing of the emergency lighting system made use of the basic principles of electronics and the cricuits analysis technology.

The use of resources available such as, electronic components, energy storage devices and domestic power supply, allow as to solve the problem of power supply outages.

Since light is very important in our life so that this project was achieved using a simplified electronics cricuiting made of battery charger unit, a lead-acid battery and an inverter circuitry.

The emergency lighting system is using a fluorescent lamp for better illumination. The indicator was used to show the different mode of the system device.

The automatic switching device chosen the operating mode.

4.3 RECOMMENDATION

After the completion of the project work, I hereby make the following recommendations.

(i) Considering the courses registered in 500 Level student should have less stress if the project topics were approved before the Industrial Training (IT).

(ii) The emergency lighting system should be used only during power supply outages.

4.4 **REFERENCES**

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