DESIGN AND CONSTRUCTION OF A 20W FLUORESCENT LAMP INVERTER (INCORPORATED WITH A CHARGING UNIT)

BY

USMAN AHMED AHMED
REG. NO. 2000/9934EE

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

OCTOBER, 2006

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF ELECRICAL AND COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY, MINNA,
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING DEGREE (B. ENG.) IN ELECTRICAL AND COMPUTER ENGINEERING.

OCTOBER,2006

DEDICATION

This project work is dedicated to almighty Allah, for his mercy, guidance and protection granted me, throughout my research. I will also like to dedicate this to my parents, Alhaji Usman Ahmed and Mallam Ado Ahmed Galadima. Also to my elder brother and sister GRP. CPT M.R. Dabo and Hajiya Maimuna R. Dabo for their financial and moral support. The work is equally dedicated to my brothers and sisters.

DECLARATION

I USMAN AHMED AHMED hereby 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

With profound gratitude to Almighty, the beneficient and the most merciful who has been sustaining me in life, I do hereby acknowledge the great contributions of those individuals who in various ways assisted me in successfully carrying out this research work.

I wish to acknowledge the untiring efforts of my supervisor Mr. J.A. Ajiboye.

My undying gratitude goes to my Late Mum Mallama Khadijat for her spiritual, moral and financial support, to my Dad Alhaji Usman Ahmed for his support: My uncle, Mallam Ado Ahmed Galadima.

Special thanks to my elder brother and sister GRP CPT MR. Dabo and Hajiya Maimuna Rabiu Dabo for their moral and spiritual support

ABSTRACT

Due to the interruptive nature of electricity supply in Nigeria today and high cost of procuring stand by generating set it becomes necessary to look for alternative methods of generating electricity for domestic used.

The purpose of this work is to develop a DC- AC inverter and charging units as an alternative to the use of generating set because its low cost and its maintenance free nature.

The 20w fluorescent lamp inverter and charging units was designed using transistor as the main inverter switching components.

The charging units can power fluorescent lamps from a 6v battery.

The method, procedure and the realization of device to achieve the above set objective are contained in this project report.

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CHAPTER ONE

1.1 INTRODUCTION

The 20W rechargeable fluorescent lamp inverter is aimed at providing alternative source of electricity for lighting in an emergency situation.

A remarkable number of ways through which energy can be stored has been devised.These are storing energy in form of a battery, solar energy etc.

However, some have generating sets, to provide alternative means of generating A.C mains. The generating set has some disadvantages, such as noise pollutions, Air pollution and the need to be buying fuel which is quite expensive nowadays.

Therefore, the better alternative means of power supply to industrial machine, commercial and residential equipment is needed. The power inverters meet this need.

This is the reason why power inverter was developed to ensure reliable power supply.

In this project, the system design is the type that supplies power to the fluorescent lamp when there is a power failure from the mains. 6V D.C battery is used to supply the inverter system, with the required energy which is then transformed in to A.C mains to power the fluorescent lamp.

The system that is to be designed in this project is the type of power inverter that invert 6v D.C to 230v A.C when there is power failure or interruption of power supply. The complete inverter system is made up of battery charging

The system that is to be designed in this project is the type of power inverter that invert 6v D.C to 230v A.C when there is power failure or interruption of power supply. The complete inverter system is made up of battery charging unit, which utilise power from the mains to change the battery as long as the power remains on. The other units is the inverter unit, which invert the D.C (DIRECT CURRENT) from the battery to alternating current (A C), and it is used to invert 6v D.C to 230v A.C.

1.2 SIGNIFICANCE OF THE PROJECT

The 20W fluorescent lamp inverter is used to provide an alternative means for lighting when there is power interruption from public supply.

1.3 SCOPE OF THE PROJECT

This project can only be used to run a 20w fluorescent lamp from any 6v D.C source capable of delivering 4.5A. There are various types of inverter, but this is specifically designed to carry 20w fluorescent lamp.

1.4 TRANSFORMER

Two transformers were used for the whole inverter system, one in the charging unit and the other at the inverter output.

1.4.1 Step-Up Transformer

The step – up transformer, step up 6v D.C from the battery at the primary side to 230v A.C at the secondary side. The transformer is a centre tapped one, with feed back.

1.4.2 Charger Transformer

This is a small transformer of 230/12v for charging the battery used in the system. However, since 12v D.C is used for the purpose of this work, a 12v transformer is appropriate.

1.5 CHANGE OVER SWITCH

These are the switches used to connect and disconnect the battery. It also connects the load to the inverter.

1.6 DEFINITION OF TERMS

- Illumination:- The degree of brightness or dullness of an area when a source of light is fixed on it.
- Inverter: This is the heart of the whole design, they are used to invert direct current to an alternating current (DC-AC).
- Rectifier: They are used to convert alternating current (A.C) to direct current (D.C).
- Powering: This is the ability of energizing a system or feeding the system. .

CHAPTER TWO

2.1 LITERATURE REVIEW

The role of modern electric power supply can not be over- emphasized since there is need for a reliable power supply; research has been going on to device means whereby there will be no interruption in the power to our electronic equipments.

The fundamental of electrical power engineering was laid as far back as the middle of the 19th century, when 1831, the English scientist Michael Faraday discovered the phenomenon of electromagnetic induction. Further studies of interaction between electric current conductors and electromagnetic field led to the invention of an electric generator which converts the mechanical energy into electrical energy.

However, the definitive advantages of A.C current over D.C current were established by the three – phase A.C system built by M.O DOLIBO-DOBROVOLSKY in 1888. The rotating magnetic field of the system allows the wide use of most simple, inexpensive dependable and compact inductive motors. Engineered by M.O DOLIBO DOBROVOLSKY.

The first inverter circuit was developed by an American company called the HEART INTERFACE in the year 1983. In 1984, there was an improvement in the inverter technology as the MOSFET was introduced to make the design smaller, and to switch larger current.

Project report of inverter design for 2001 future energy challenge by student team; JOY MAZUMDA, DUY BIU, MANASI, NANCY SAIDHANA, SEVE PUGH, and BASSEM KHURY from college of engineering and computer science, university of central Florida, Orlando was carried out. In their report dated 15th June, 2001, for a design of high power density, 10KW inverter circuit was presented for conversion of energy from D.C fuels cells to A.C power to be mainly for domestic utilities. The configuration was achieved using a high frequency D.C push pull converter at the input side followed by a full bridge inverter and a low power filter at the output side. Due to the simplified power stage and the application of the DSP (Based sinusoidal pulse width modulation technique). Output voltage total harmonic distortion (THD) is reduced and a relatively smaller overall inverter size is achieved. The practical circuit operation from a 48V D.C fuel cell input and output a regulated 120V A.C, 60HZ sinusoidal voltage having 3-wire configurations. A low power inverter has been redesigned tested and prototypes to deliver a 1.5KW load. There are also project work done by some of the students of this department on design and construction of 500VA inverter. (Adeoye Emola John, 2000). He used 555 timers in astable mode for signal generated and TTI dual JK flip-flop for pulse width modulation and frequency division. The deficiency of the work is the use of the TLL, JK flip-flop, which consumes much power with less efficiency.

Also (Abachi Eugene 2004) used CD40471C in astable mode to deliver currents to the transistor.

The inverter/charger is a system that ensure continuous supply of electrical power when there is an outage, by conversion of D.C which is drawn from secondary cell.

There are different kinds of inverter. Beside the input voltage, output voltage and power rating. There are inverters that output the power at different waveforms.

The three most common output wave forms for inverters are square wave form, modified sine wave form (some times called quasi sine wave) and sine wave output. Square wave is the simplest method that is widely used in the cheap bow power device. Many years ago this was the only wave form available as cheap inverter. Square wave form inverters generally consist of an oscillation driven switching transistor, that switch incoming power to different sides of the center tapped transformer primary. The square wave mains voltage is outputted from the transformer secondary. The converter transformer can be pretty similar to normal 12V-120V or 12V-230V mains power transformer rated to inverter power rating. The square wave power at the output can cause problems in equipment originally designed for the sine wave.

Most devices with the variable speeds such as electric drills, or cordless screw driver can behave irrationally when operating with modified sine or square waves inverters.

The modified "sine wave" form is becoming popular nowadays. Inexpensive inverter is quite easy to make with modern electronics. This type of inverter generally uses a switch mode power supply that generates 150-300V D.C that is then switched to the output at right way using few high voltage power transistors/field effect transistors.

Modified sine wave is made from two square wave out of phase. The phase is adjusted with a load.

2.2 A THEORETICAL REVIEW ON INVERTERS

An inverter is generally known as a converter. Just as the rectifier converts an A.C power into a D.C power, inverter convert D.C power into an A.C power. However, converter is a general term embracing both rectifiers and inverters.

The inverter circuit is concerned with the process of inverting (changing) the D.C output from the accumulator or the bridge rectifiers to an A.C signal (voltage) during operation. Inverters are basically made up of multivibrators.

The 20W fluorescent lamp inverter is mainly for 20W fluorescent tubes, although it can also be used for some other appliances that is within the specified power (20W).

CHAPTER THREE

PROJECT DESIGN DETAILS

3.1 DESIGN DETAILS

The inverter was designed to invert direct current to alternating current. So therefore the whole system comprises of battery charging unit, the battery and the inverter unit. The direct current is obtained from the battery which is then used by the inverter to convert DC voltages to AC voltage. For constant supply of the DC voltage to the inverter a battery charger is needed to constantly charge the battery.

However, this shows that the circuit has two main circuit units, the battery charging circuit and the inverting circuit. The inverter circuit has two main units, namely: the inverting unit and power amplification unit. The inverting unit converts the direct current to alternating current, while the power amplification units amplifies the alternating current to the required power needed at the output.

3.2 THE BATTERY CHARGING MODULE

Basically, there are two method of charging batteries which are

1. constant-current charging method
2. constant-voltage charging method

Other methods which are also used but are modified forms of the above mentioned are,

1. Booster or high rate charging
2. Trickle or slow rate charging

The circuit below shows the battery charging circuit.

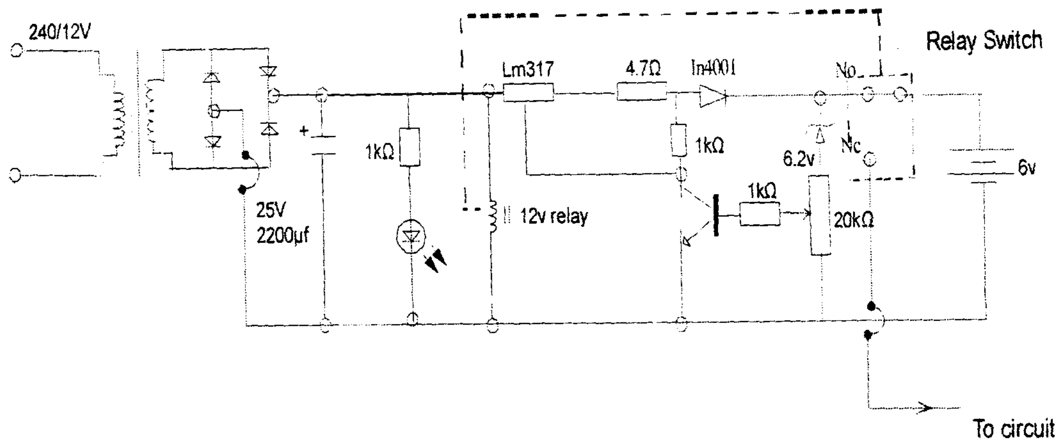


FIG 3.1 Circuit diagram of the charger section

3.2.1 The Rectification Diodes

The battery can be recharged when its energy content has been used up. To charge the battery used in this project a charger is employed to recharge the battery system. The charging circuits started working when there is Ac mains supplied. The Ac voltages from the mains is stepped down by the step down transformer from 240v AC to 12v DC. The AC voltage is then rectified to DC through the full bridge rectifier. The figure below shows the full bridge rectifier circuit.

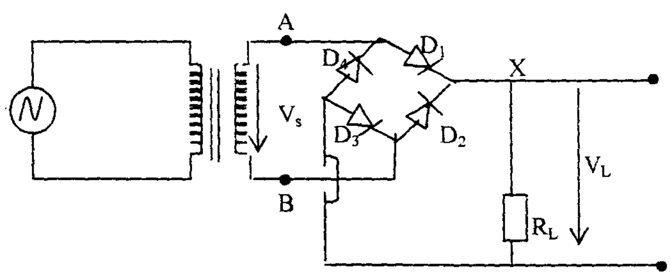


Fig 3.2 Bridge Rectifier Circuit

The circuit avoids the use of centre-tapped transformer though at the expense of two additional diodes. During the positive half-circle of the input AC signal Diodes D1 and D3 conduct while diodes D2 and D4 are reversed biased. Hence a current I flows in the direction AX and the output voltage VL drop across the load resistor RL as shown in the figure above.

During the negative half circle when point A is at lower potential than point B, diodes D2 and D4 now conduct while diodes D1 and D3 are reverse biased. Hence current I_L flows in the direction BC that is current flows in the same direction through the Load as before.

The figure below shows the output waveform.

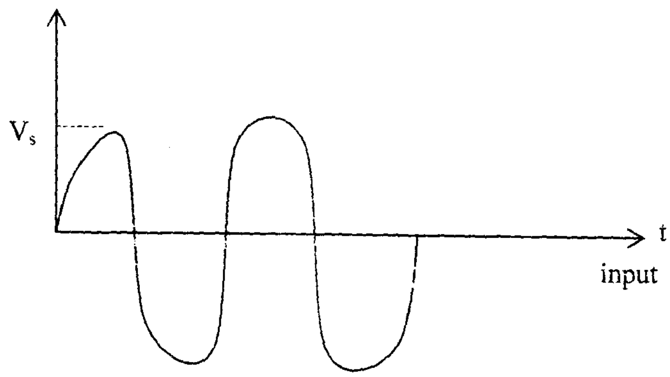


Fig 3.2a Shows the wave forms of voltage input to the diodes

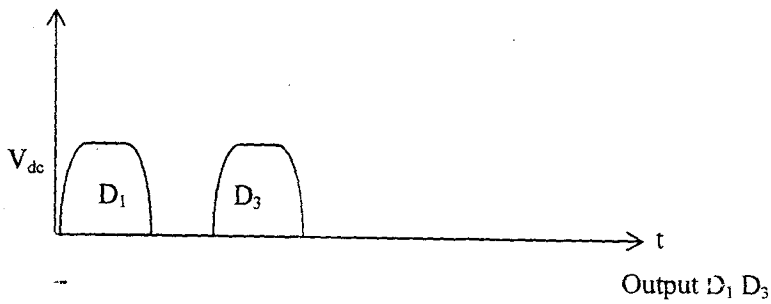


Fig 3.2b

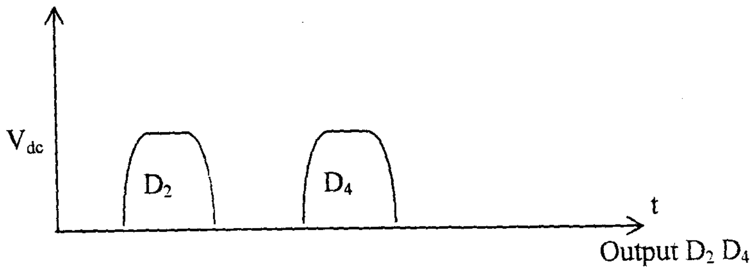


Fig 3.2c

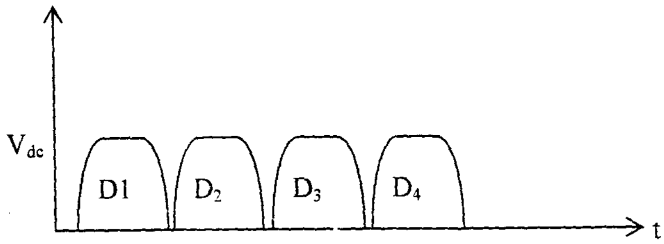


Fig 3.2d Total output wave form

3.2.2 LM 317

The LM317 adjustable is a 3 – terminal positive voltage regulator capable of supplying in excess 1.5A over a 1.2 to 37v output voltage. The LM317 regulator is exceptionally easy to use and requires only external resistor to serve the output voltage. The LM317 offers a full over load protection current limit, thermal overloads protection and safe operating current (50A) protection.

Normally, an LM317 requires no capacitor unless the regulator is situated more than six (6) inches' from the input filter capacitor. The LM317 can be used as a precision current regulator.

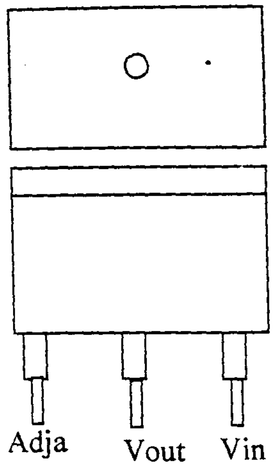


Fig 3.3a LM 317 Pin Diagram.

The application units for LM317, the regulator develops a nominal 1.25v reference voltage, V_{ref}, between the output and adjustable terminal. The reference voltages impressed across the resistor R1 and since the voltage is constant, a constant current (I) flows through the output resistors R2 given an output voltages.

$$V_{out} = V_{Ref}\,(1+{}^{R_2}\!/_{R_1}) + I_{adj}\,R_2$$

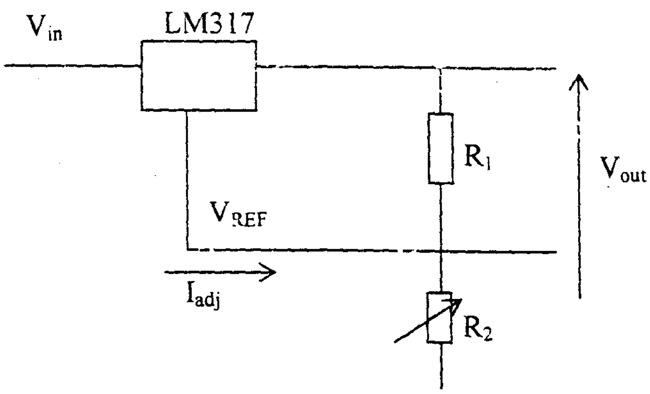


Fig 3.3b showing LM317 voltage Application units

The LM317 is configured as a constant current, constant voltage regulator to charge the two 6v, 4.5AH lead acid batteries that provide power to the inverter units.

At the beginning of the charging cycle when the battery voltage is less. The base of the 2sc 1815 Transistor Q1 is OFF.

This allows the adjustable voltage regulator to operate as a constant current source. The regulator therefore forces a constant 1.25v across R_{LIM}, thus generating a constant current of

$$I_{LIM} = \left(1.25v / R_{LIM} \right) A$$

R_{LIM} was chosen so as to produce a charging current at 1.25A. as the batteries begin charging, their voltages rise and is sensed at the output of the 6v zener diode.

The 20KΩ trimmer resistor and V_2 plus 0.6v needed to turn on Q1, Q1 starts controlling the adjustable pin of the LM317 which then starts to regulates the voltage across the battery and the constant voltage portion of the charging cycle starts. Immediately the charger is in the constant voltage mode, the charger maintains a regulated voltage across the battery and the charging current is dependent on the state of charged battery. As the cell approaches fully chargeds condition, the charging current falls to a very low value.

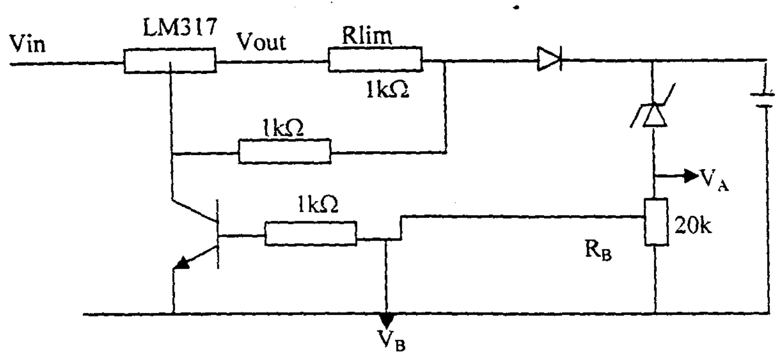


Fig 3.3c Showing LM317 with load

The LM is configured to generate a constant voltage of 6v minimum: and (V_{in} − 1.25)V (maximum) across the two lead acid batteries.

The output voltage is determined from the expression

$$V_b = 0.6v = V_a R_b / (R_a + R_b) \quad (1)$$

But $V_a = (V_{batt} - V_2)$ (2)

$$V_a = (V_{batt} - 6) \quad (3)$$

$0.6R_A + 0.6R_B = V_A R_A$

Substituting equation 2 into equation 3

$$0.6R_A + 0.6R_B = (V_{batt} - 6)^* R_B \quad (4)$$

$$0.6(R_A + R_B) = V_{batt} R_B - 6R_B \quad (5)$$

$$V_{batt} R_B = 0.6(R_A + R_B) + 6R_B$$

$$V_{batt} = \frac{0.6R_A + 0.6R_B + 6R_B}{R_B}$$

$$V_{batt} = \frac{0.6R_A + 6.6R_B}{R_B}$$

$$V_{batt} = 0.6\left(\frac{R_A}{R_B}\right) + 6.6$$

Thus the battery voltage is programmable for any chosen value of R_a and R_b.

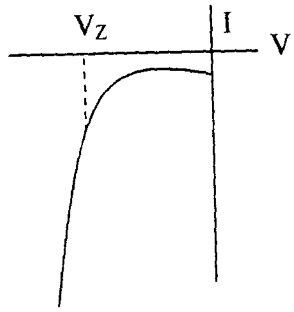
The IN4001 diodes is used to prevent the battery current from flowing through the LM317 regulator from the output to the input when the DC input voltage from the battery is removed.

The 25v 2200μF by pass capacitor is used to stabilise the operation of the charging system.

3.2.3 The Zener Diode

In normal power supply circuit, the input voltage to the rectifier may vary. due to fluctuation of the AC mains. This may result in variation of output signal. The function of the zener diode as a voltage regulator is to provide a steady value of the output voltage despite possible variation of the input voltage or load. Zener diode operate in the reverse bias region and should therefore be connected in the circuit. If the reverse voltage is increased from 0 volt, only the reverse saturation current flows. At the breakdown voltage Vz, however, the negative current starts to increase appreciably. Any voltage higher than Vz applied to the diode does not increase the output voltage despite the rapid increase in the reverse current.

The figure below shows zener diode V-I curve and circuit symbol.



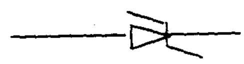


Fig 3.4 (b) circuit symbol

Fig 3.4 (a) V – I curve

3.3 THE INVERTER MODULE

There are different ways of achieving inversion from DC to AC based on the components used. Example of such components are transistors, Integrated circuit. For this project work the BJTs (NPN) transistors is used since the aim is to achieve a low power output for lightening.

The inverter unit is divided into the following sub units.

1. Transistor switching unit
2. Power transformer.

3.3.1 Transistor switching unit

This is made up of two NPN transistors used as switches, the need to achieve switching between inverter and charger by the use of a relay is eliminated.

The transistor has to be operated in its saturation and cut off regions for it to serve as a switch.

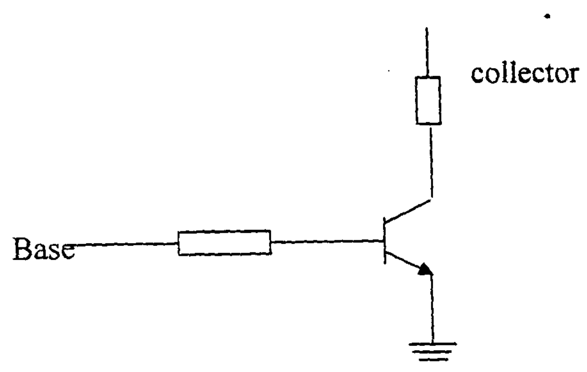


Fig 3.5 Typical BJT switch

3.3.2 Operation of BJT

In order to get the transistor ready for operation, the two PN junctions must be appropriately biased. The rule of biasing the Bipolar Junction Transistor (BJT) is

Forward bias the Emitter-Base Junction

Reverse bias the Collector -Base Junction

The biasing rule is illustrated in the figure below for NPN transistor.

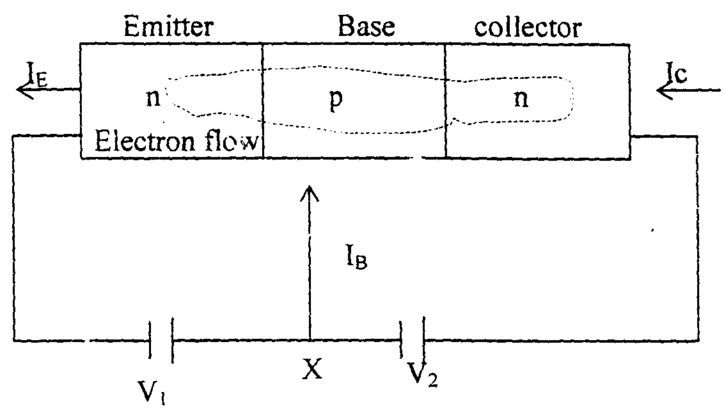


Fig 3.6 biasing and operation of NPN transistors

Under this biasing condition, a large number of electrons (majority carriers) in the emitter region are injected into the lightly doped and relatively thin baseholes in external circuit. However most of the electrons (injected) are drifted to the collector region by positive potential of batteries V_2 to form the collector current Ic. The injected electrons from the emitter form the emitter current Ic. The injected electrons from the emitter form the emitter current.

3.3.3 Current Relationship in BJT

The kirchoff's current law for node in the figure above

$$I_E = I_C + I_B$$

$$I_C = \alpha I_E$$

$$\alpha = {}^{I_C}\!/_{I_E}$$ Ratio of collector current to the emitter current.

$$I_C = \left(\frac{\alpha}{1-\alpha}\right) I_B = \beta I_B$$

$$\beta = \frac{I_C}{I_B} = \frac{1}{1-\alpha}$$

For this transistor to serve as a switch, it must be saturation and cut off region.

The figure below shows typical characteristic curve of BJT.

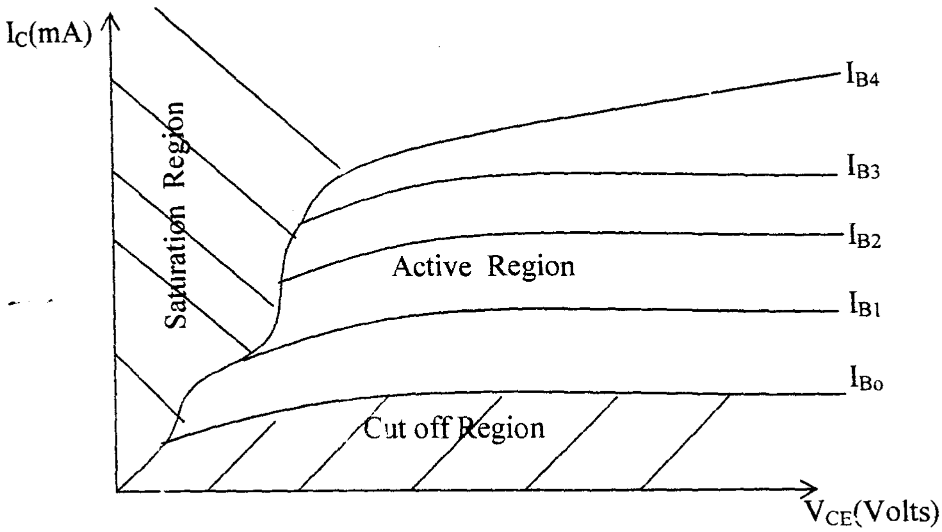


Fig 3.7 typical characteristic curves of BJT.

1. Saturation region:- where Ic rise rapidly with increase in Vce
2. cut off region:- where I_B is zero in this region only a small leakage current, I_{CbO} flows, I_{CbO} is the reverse saturation current flowing between this collector and the emitter when the base current is zero.

The collector current at saturation point is given by

$$Ic(sat) = \frac{V_{CC} - V_{CE(Sat)}}{R_C}$$

$$= \frac{V_{CC}}{R_C}$$

I_B must be greater or equal to 50µA for the transistor to be in saturation.

$$IC(sat) = \beta I_{B(sat)}$$

$$I_B = \frac{Vi - Vt}{R_B} \geq I_{B(sat)}$$

where

Vi = input voltage

Vt = threshold voltage (usually 0.7v)

$$R_B \le \frac{Vi - Vt}{I_{B(sat)}}$$

Let R_B = 330Ω

Vi = 6v

Vt = 0.7v

$$I_B \le \frac{6-0.7}{300} = 16mA$$

3.3.4 Resonance Frequency Choke

This Rf choke is an inductor to preset the circuit frequencies above the specified frequency without affecting the flow of 6v DC. The RF choke used in this project work is to adjust the frequency of the circuit, whereas the DC to the inverter circuit is unaffected.

The frequency of the inverter is 25khz.

$$C = 0.1\mu F$$

$$F = \frac{1}{2\pi\sqrt{LC}}$$

$$25\times10^3 = \frac{1}{2\pi\sqrt{LC}}$$

$$\sqrt{LC} = \frac{1}{2\pi\times25\times10^3}$$

$$LC = \left(\frac{1}{2\pi\times25\times10^3}\right)^2$$

$LC = 4.05 \times 10^{-11}$

$$L = \frac{4.05 \times 10^{-11}}{0.1 \times 10^{-6}} = 405\mu H$$

$$\therefore L = 405\mu H$$

3.3.5 Power Transformer

A transformer is an electrical device which transfers energy from one circuit to another by electromagnetic induction.

A transformer is also an electrical AC component which consist of two or more coils that are linked together by mutual inductance. It is used to transfer electrical power from one coil to another. It can also be used to change voltage, current or impedance from one value to another.

A step-up transformer with a center tap was used at the inverter output section. The circuit symbol of a step-up transformer is shown in the figure below. The transformer also has a feed back section which compares the output frequency with the input.

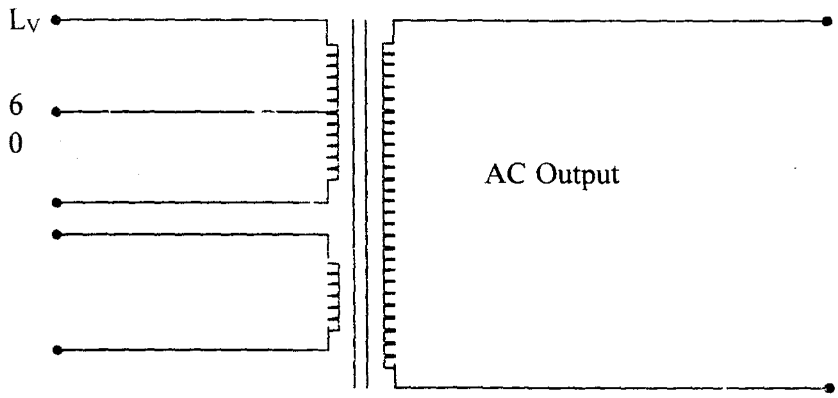


Fig 3.8 Showing centred-tapped transformer.

The transformer voltages and windings is related by the equation

$$\frac{V_2}{V_1} = \frac{N_2}{N_1}$$

V_1 and V_2 are the voltages in primary and secondary windings N_1 and N_2 are the number of turns in the primary and secondary windings.

The output voltage of the inverter is to be 240v, and the input voltage is 6v. The output power of each section is 20w

$$I = \frac{20}{240} = 0.08A$$

$$\therefore \frac{V_2}{V_1} = \frac{N_2}{N_1}$$

$V_2 = 240v$

$V_1 = 6v$

Number of turn in primary is 8 – 8- 3

3– turns is the feed back

Total number of turns = 16 – 3 = 13

$$\frac{240}{6} = \frac{N_2}{13}$$

$$N_2 = \frac{240 \times 13}{6}$$

$$N_2 = \frac{3,1200}{6}$$

$N_2 = 520$

$\therefore$ The number of turn in the secondary winding is 520 turns so this number of turns was used for the desire power output in each case the inverter neglecting power losses.

Input power = output power

$$V_1 I_1 = V_2 I_2$$

OR $\frac{I_2}{I_1} = \frac{V_1}{V_2} = K$

K is the transformation ratio

Output of inverter = 20w

Output voltage = 240v

$$I_2 = \frac{V_1 I_1}{V_2} = \frac{20}{240} = 0.08\text{A}$$

$$I_1 = \frac{V_2 I_2}{V_1} = \frac{0.08 \times 240}{6} = \frac{19.2}{6} = 3.2\text{A}$$

3.3.6 Status Indicator

This is made up of two (2) light emitting diodes, the yellow LED is connected to 20w section of the inverter circuit to indicate the mode in which the inverter is and the red LED indicates the battery charging mode.

3.3.7 Battery

This serve as the source of DC input to the inverter. The quantity of electrolyte which the battery can give in a single discharge is its capacity. This means it is the product of the discharge current and discharge time. It is expressed in ampere-hour (AH). The AH is the amount power the battery can discharge over a period of time. The battery bank should have batteries connected to each other in parallel. This helps in increasing the Ampere-hour rating. When this parallel connection is made, the voltage of all the batteries in the bank is the same, but the ampere-hour (AH) ratings becomes the sum of the ampere-hour (AH) rating of all the batteries in the bank.

To calculate power requirement of a device say 50WATT

Assuming efficiency of 75%

DC AMPs = $Power/Battery\,voltage = 50/6 = 8.33A$

Actual DC AMPs x Efficiency factor

But Efficiency factor = $\frac{100}{75} = 1.33$

= 8.33 x 1.33

= 11A

If the device is to be used for 2 hours, therefore

Ampere hour consumed = 2 x 11A

= 22AH

This battery of 60AH is suitable for the inverter.

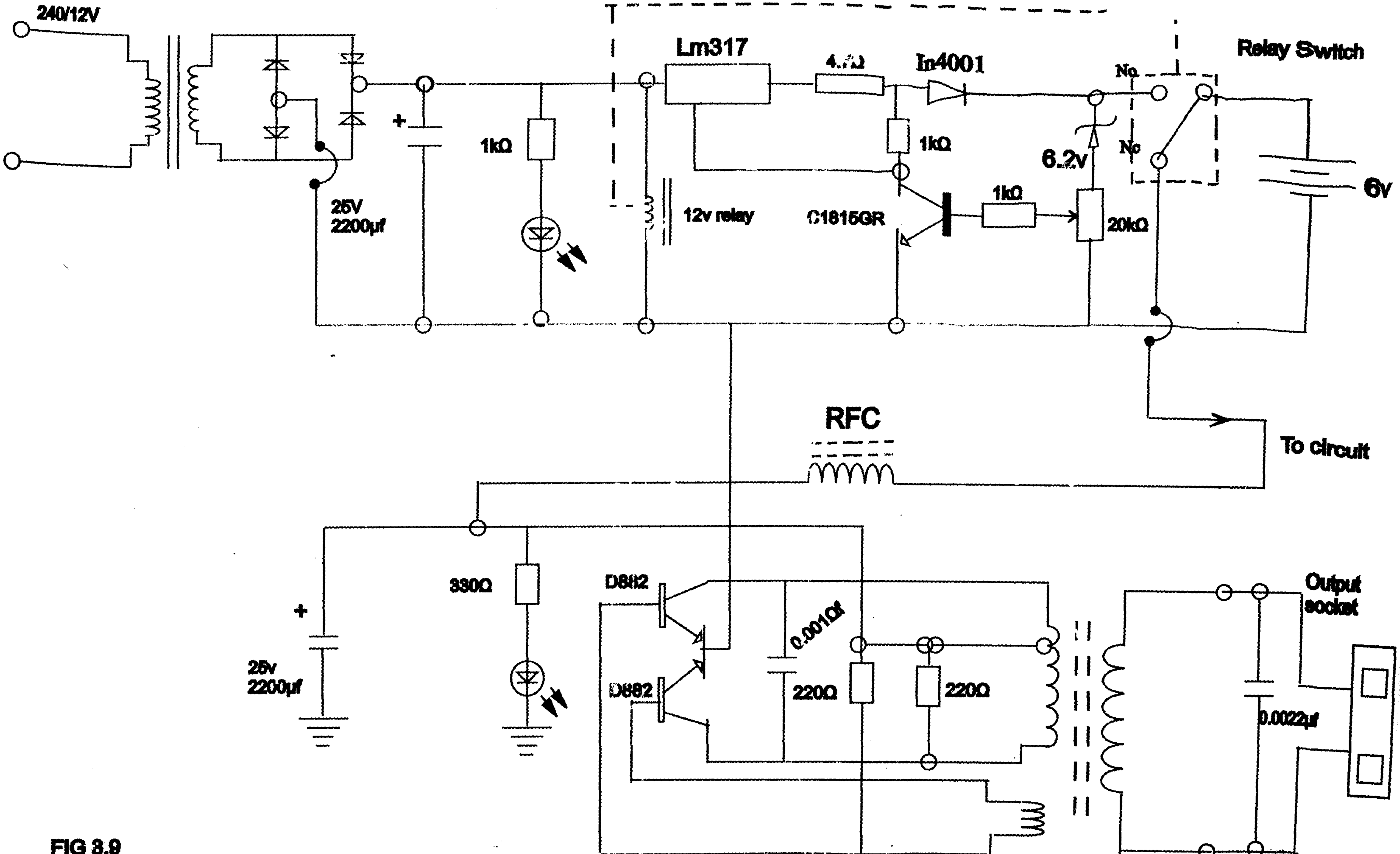


FIG 3.9
CIRCUIT DIAGRAMS OF COMPLETE INVERTER WITH CHARGER

CHAPTER FOUR

TESTS, RESULTS AND DISCUSSIONS.

4.1 TESTING

The circuit was first designed and simulated using multism. Each unit of the design was simulated first using multism software on a computer. Then it was also tested on a breadboard, before it was transferred to the veroboard.

The output voltage of both inverter and charger unit was measured using digital multimeter. The circuit component was then connected on the breadboard temporarily as per circuit design specification. The battery charger circuit was first implemented on the breadboard and tested. Also the inverter system was also built on the breadboard and the output voltage measured. and it was found to be in accordance with the specification.

The whole system was then transferred to the veroboard, carefully, with construction of the diodes first, followed by other units.

4.1.1 Soldering Process

The component that is to be soldered, a 60w soldering iron supplied the require heat needed with lead to hold the components permanently on the veroboard. The system was then ready for packaging.

4.1.2 Packaging

The complete constructed circuit on the veroboard was then housed in a plastic casing.

4.1.3 Precaution

The entire designed construction would have been a failure if certain precaution were not taken.

Some of these precautions include:-

1 All components were properly soldered into their appropriate place on the veroboard.

2 Over heating of the component was put into consideration during soldering process.

3 The values of the components though not exact, were ensured to be close to the required values

4.2 RESULTS

The 20w fluorescent lamp inverter was constructed and used with fluorescent tubes and it's power consumption is shown in the table below:-

Table1 power consumption of some electronics and electrical appliance

APPLIANCES	POWER CONSUPTION
1 Fluorescent tube	20watt each

4.3 DISCUSSION OF RESULT

From the result obtain, on testing a 20w fluorescent lamp inverter it was discovered that the results obtained was satisfactory. The system was able to power the tube successesfully.

This project is limited to D882 transistor. A BU208B would have been better, but because a BU208B is not available in the market, that is why a D882 is used as a replacement. Also this project is limited to just 20w fluorescent lamp because the wave form of this inverter is a pure sine wave and it has only twenty watts output power.

CHAPTER FIVE

CONCLUSION AND RECOMMANDATION

5.1 CONCLUSION

Conclusively it is obvious that there is a realistic solution to power outages in Nigeria. The cost of an inverter system that has the same power output with some generator is far lower than the cost of the generator, which implies it is a device that an individual could afford.

The art and technology are in existence. In addition, more knowledge and understanding of transformer winding, transistor as a switch and amplifier was acquired.

The inverter device is also very cheap to maintain compared to the generating sets that needs to be fuelled to maintain constant operation. The inverted does not produce any noise like other generating system of it's capacity which produce unbearable noise when in use.

Finally, this project has been very interesting and worth going through by every graduating student in order to expose them to the practical of what is being learnt in the class. This will also create confidence in student after graduation, when they go out to the practical fields of electrical engineering due to the practical experience gained in the design and construction of their project.

5.2 RECOMMENDATION

Since the field of electronics remains ever dynamic, it is always very possible with no limitations, to modify the design for better performance. In view of this I recommended that any student who wish to embark on this type of project should use:-

- Power mosfet for switching large currents.
- The device is recommended for use as an alternative source of electricity for lighting in an emergency situation at the event of interruption of power supply.
- The device should be incorporated with a thermistor to sense heating within the circuitry.
- An IC can be incorporated into the circuit such as SN 7401C, 74041C to oscillate the incoming DC signal.

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REFERENCES

[1] Y.A. Adediran.: Applied Electricity, Finom Associates, Minna – Nigeria, 2000, pp. 121 – 150.

[2] Micheal Nelkon and Phillip Paker, Advance Level Physics Seventh Edition, Heineman Publishers, 1993, pp. 803 – 804.

[3] George C. Chryssis, High Frequency Switch Power Supplies Theory and design, published by McGraw Hill, New York, 1994, pp. 114 – 118.

[4] William L. Faissler, An introduction to modern Electronics, published by John Will and Sons, Inc. 1991, pp. 295 – 297.

[5] Robin Mu, Power Electronics Converter, Application and Design, published by John Willey and Sons, New York, 1991, pp. 2 – 5.

[6] Paul H. and Winfield H., The Art of Electronics, Published by Cambridge University Press, 1995, pp.48.

[7] Howard H. Gerrish and William E. Dugger, Electricity and Electronics, Published by Goodheart – Willcox Company, Inc., South Holland, Illinois, 1996, pp. 230 – 235.

[8] www.epanorama.net.ups

[9] www.hobbysproject.com

[10] www.allaboutcircuits.com

[11] www.electronicslab.com.