DESIGN AND CONSTRUCTION OF 600WATT UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM

BY

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CERTIFCATION

This is to certify that this project titled **"DESIGN AND CONSTRUCTION OF A 600W UNINTERRUPTED POWER SUPPLY (U.P.S) SYSTEM"** was successfully carried out by **SHEHU D. SHEHU (97/6163EE)** under the supervision of **MR. ERUNU** and submitted to electrical and computer engineering Department, federal University of Technology, Minna in partial fulfillment of the requirement for the award of a Bachelor of engineering (B.Eng) degree in Electrical and computer engineering.

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CHAPTER THREE

CHAPTER FOUR

DEDICATION

Firstly, I would love to dedicate this work specially to Almighty Allah (S.W.T) who is the stronghold of my life. I thank you for all you have done for me and all your promise to do in the nearest future.

Secondly, to my parents. Thank you for all the support and training you gave me. Without both of you, life would have been unimaginable different. May you both reap the fruits of your labour. Amen!.

SHEHU D. SHEHU

16-10-2013

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ABSTRACT

Certain types of electrical equipment such as computer and communication device are very critical when it comes to the quality of their power supply. Harmful influences, electrical surge and power outrage can be very disturbing.

Hence the needs for UPS cannot be over emphasised, the UPS must provide AC output such that means of failure is unelected by the wad. This project highlights the design and construction of an Uninterrupted Power Supply.

This made possibly by use of high current semi-conductor FET (BIPOLAR) switches that convert A voltage to an equipment by changing over to an inverted backup D.C voltage in the event of mains failure or other irregularities in the mains supply.

During the process of the circuit designed for the UPS, various factor such as change over speed, power

quality and efficiency were amongst the various components employed. The pulse obtained from 555 timers IC in which the output signal is divided into two by the help of J.K. FLIP-FLOP. This two signal were used to drive the switching circuit in the inverter unit.

The (UPS) unit was designed to convert a 12V d.c 30a maximum supply to feed a 600watts 240v ac load at 50Hz.

CHAPTER ONE

1.0 INTRODUCTION

When electrical power is generate, it is both clean and stable, but during transmission and distribution, it is subjected to a variety of harmful influences like electrical systems, noise, large variation in loads and accident resulting in blackouts, over voltages, under voltage and voltage spills. All ,these power supply disturbances may cause some of the sensitive equipment to strip out. The supply problem can be over come by connecting an uninterrupted power supply (UPS) between (AC) input power supply and sensitive load equipment, where it will not only clean up any supply aberration, but will also maintain the critical load during a complete outrage.

Uninterrupted power supply provides both powe conditioning and back ups. Basically, UPS consist of battery charger the inverter, filter, and battery bank. The filter and charger convert the AC power source to DC. The

battery bank is the source of D.C supply to the inverter. when there is maih power outrage or failure it will be converted to AC to feed the load through static by-pass switch.

Uninterrupted power supply is used to supply computer, industry and 'air traffic control system where power failure can cause damages to the loads. UPS systems achieve this by rectifying the standard main supply, using the current to charge the standby battery and to produce "Clean" alternating current (AC) by pressing through an inverter and filter system.

1.1.0 AIMS AND OBJECTIVES

The uninterrupted power supply is designed to have output of 500VA that can carry a maximum load of 650 watts with a voltage output of 220 volts for duration of one (1) hour minimum.

1.2 BASIC STRUCTURE OF UPS

The uninterrupted power supply is made up of inverter, charging unit, over loading protection, low battery detector and change over switch.

1.2.1 INVERTER

An inverter is a device that change d.c power into a.c power (just the opposite of converter). Thus providing precisely regulated output voltage and frequency to the load when there is power outrage.

1.2.2 BATTERY CHARGER

A battery charger is an electrical device that is used for putting energy into a battery. The battery charger charges the AC from the power line to DC suitable for charger. The charging unit also includes rectifier, which can be full or half wave.

1.2.3 FILTER UNIT

The output of converter from transformer is a square waver known to sinewave super imposed on several

harmonies, it is the filter unit that will filter the transformer output signal to prevent damages to inductive loads.

1.2.4 OVER LOADING PROTECTION

The overloading protection is made up of fuse to protect the system from overloading. The fuse is perhaps the simplest and cheapest form of protection and is used to protect low voltage equipment against overloads and short circuit. The maximum value of current that fuse will conduct without melting in this project is 2 amps. which is known as the fuse current rating.

1.3 TYPES OF UPS

UPS can be classified into the following categories depending on the way it was design to operate. Each of the categories has it's own advantages and disadvantages. Basically we have four (4) types of UPS. namely Dual Track UPS. Double conversion Ups. forroresonat UPS and single Track UPS.

1.3.1 DUAL TRACK UPS

This is a system that contains a stable by-pass alternative power path. The alternative power path is switched on when the inverter faulty. The advantage of this dual track is that when the inverter fail and raw power present, there is still supply to the load.

The advantage of this system is that is always a delay of microsecond in the switching over from inverter to main supply see fig. 1.1 for dual tracks diagram

1.3.2 DOUBLE CONVERSION UPS

The double conversion UPS has a large charger and the inverter. It is basically a different from of single-track system. The charger converter and the inverter reconverted the DC to AC and supplies the loads through static by-pass switch.

The charger is large enough so it charges up a standby battery. On detecting a mains failure. the static by-pass

switch needs the inverter from the battery and power supply to the load is recorded uninterrupted.

The disadvantages are that any fault with inverter loads to the failure of the whole system. See the block diagram in fig. 1.2.

1.3.3 FORRORESONANT UPS

The forroresonant UPS is made-up of small charger battery, an inverter and a forroresonant.

The forroresonant transformer supply to the load when the main power is available.

The forro-create pure sine wave from the battery via inverter when main power is in acceptable.

The main disadvantage is that it use forroresonant transformer, which has the unique characteristic of providing, the level of power protection needed in UPS. It alternates spikes of high voltages and surger in the mains are absorbed by it. It stores electrical energy (fly wheel

effect), which aids in filling micro break up to 20cms in duration. See block diagram in fig. 1.3.

1.3.4 SINGLE TRACK UPS

The single tracks UPS is a system in which the inverter is always at work whenever the system is under operation. It is a two block system which features a rectified power applied to the battery and simultaneously been sent to the inverter for AC conversion. No switching take, thus no system disruption. More so the battery must keep charged at the rate equal to the rate at which power is consumed.

The load is protected from AC electrical influence. The disadvantage of this single charge will lead to complete breakdown of the system. Also this type of UPS is bulky, this is due to the large transformer that will be used at both the charger and output. See the block diagram in fig. 1.4.

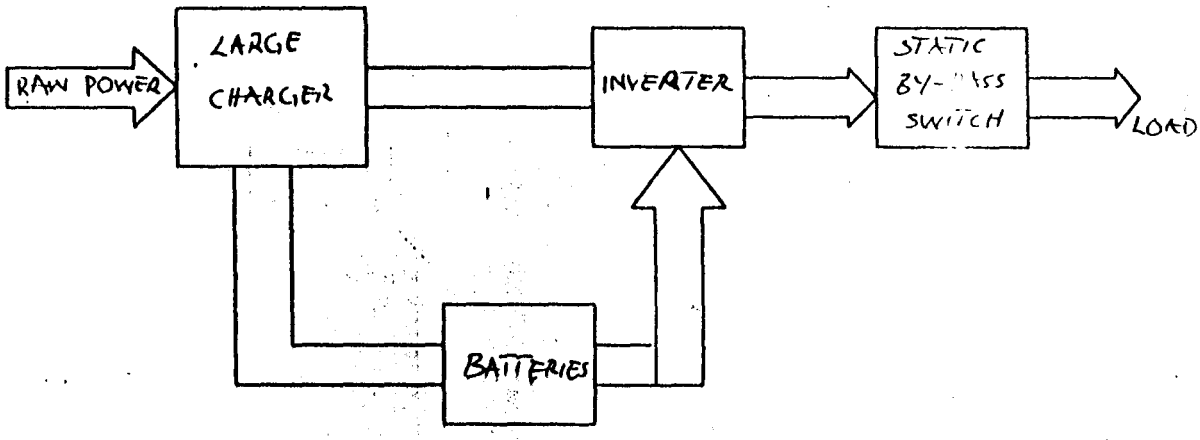


Fig. 1.1 DOUBLE CONVERSION UPS SYSTEM

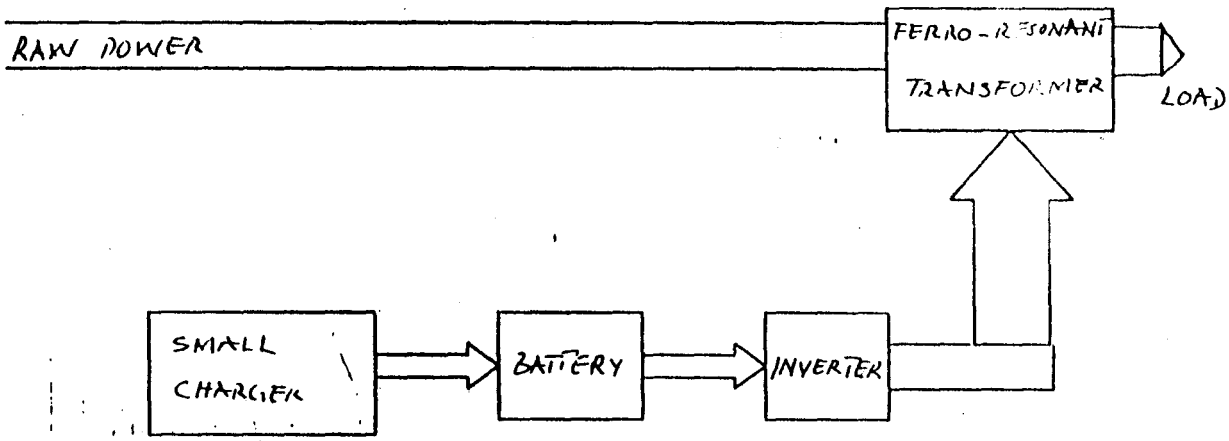


Fig. 1.2 FERRO RESONANT U.P.S SYSTEM

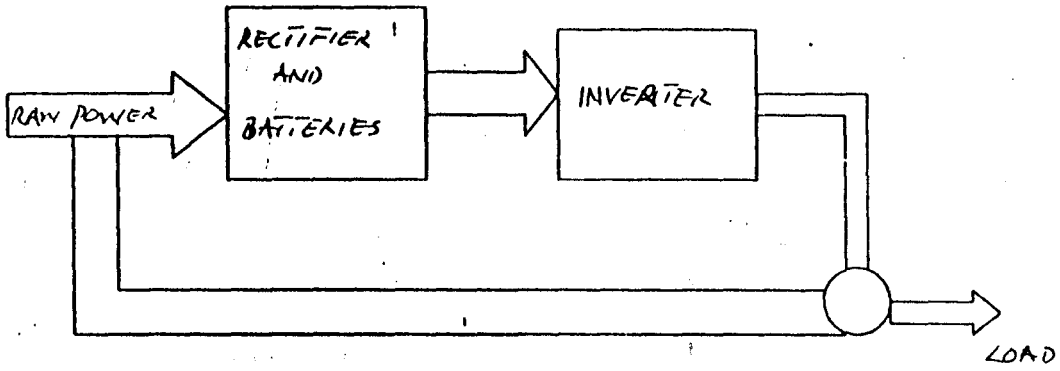


Fig. 1.3 DUAL TRACK U.P.S SYSTEM

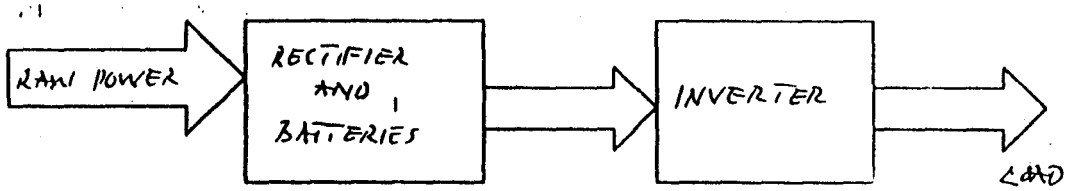


Fig. 1.4 SINGLE TRACK U.P.S. SYSTEM

1.4 METHODOLOGY AND THEORY OF DESIGN

1.4.1 RELAY

A relay is a device used to control a large flow of current by means of a low voltage, low current circuit. It is a magnetic. A flash light cell is used to energize the electromagnet. This circuit is controlled by the switch. When the coil is magnetized, it's attractive force pulls the lever arm called an ARMATURE towards the coil. The contract points on the armature will open or close depending upon the arrangement and control the larger high voltage circuit.

Relays are in varieties of forms and play important role in electrical engineering for example telecommunication and automatic control e.t.c

The internal diagram of a typical relay of electromagnetic material is shown in fig. 1.5. The relay has a coil f wire, an iron core and an iron yoke which serves on easy path for flown. imparts the polarity if the rear end if

the armature which is thus powerful attracted by the opposite polarity of the front and of the core.

1.4.2 TRANSFORMER

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 or lower the voltage in a circuit but with a corresponding decrease or increase in current. The physical basis of a transformer is mutual induction between two circuits linked by a common magnetic flux.

A transformer consists of two or more coils of wire wind round a common laminated iron core. A key advantage of transformer is that they can be used to increase or decrease voltage depending on the number of turns on the secondary winding. On a secondary having less turn than primary, voltage is decrease and in this case it is called steps down transformer. On a secondary having

more turns than the primary, voltage is increases. It is called step up transformer.

The principal components of transformer are:

(1) **CORE:** This is laminated iron sheet, which is insulated to reduce iron loss.

(2) **WINDING:** This is the number of turn of wire on the secondary and primary, the ratio depends on the application.

The following are important formular for transformer designs.

(3) **TRANSFORMER RATIO.**

$$E2/E1 = N2/N1 = K, \text{ K is constant.}$$

The constant K is known as voltage transformation ratio.

(i) If $N_2 > N_1$ i.e $K > 1$, then the transformer is called step up transformer.

(ii) If $N_2 < N_1$ i.e $K < 1$, then the transformer is called step down transformer.

(4) INDUCE E.M.F

$E = 4.44 FTQ \times 10E^{-8} V$

$Q = B \times A$

F = Frequency, T = Number of turns per winding

Q = Flux, B = Flux density, A = Cross sectional area of the core.

(5) PRIMARY EQUIVALENT RESISTANCE

$= R_1 + (T_1/T_2)^2 R_2$

(6) PRIMARY EQUIVALENT REACTANCE

$X = X1 + (T_1/T_2)^2 \times 2$

1.4.3 FUSE

A fuse is a small piece of wire connected in between two terminals mounted on insulated base and is connected in series with the circuit. The use is perhaps the cheapest and simplest form of protection and is used for protecting low voltage equipment against overloading and short circuits.

The fuse is expressed to carry the normal working current safely without over heating and during overloads or short circuits. it heated up to melting point rapidly. The materials used normally are tin. lead. silner, zinc. aluminum. copper e.t.c.

1.4.3 LITERATURE REVIEW.

Theoretical and experimental studies of electricity during the 18th and 19th century led to the development o the first electrical machines and the beginning of the wide spread used of electricity.

The history of electronics begins to evolve separately from that of electricity late in the 19th century with the identification of electronics by the English physicist J.J Thompson and the measurement of it's electric charge by the American physicist r.A Milkman in 1909.

With the breakdown in integrated circuit and semi – conductor micro processor chips haven been design and used as electronics components. The need for constant

electricity supply all around the world is in high demand. In this part of the world regular power failure is often experienced and the need to shield or protect valuable information from the computer is vital. This lead to the invention of UPS.

UPS provides a source of power or an electronic device in the event of power outrage. It allows the user to the critical load to safely shut down their devices.

Though, the project has been work upon with ranges from 250VA to 500VA. The scope of this project is to improve on the work done in terms of power output to 600VA, less failure rate, longer time of operation, trickle charging current efficiency e.t.c.

1.4.5 PROJECT OUTLINE

The scope of this project is subdivided into four chapters. Chapter one of covers aims and objectives, and also contains the literature review, methodology

and various types of ups and general introduction about the project.

Chapter two contains the system design given brief explosion of power supply and the conversion of DC to AC inverter section, the battery charges circuit unit and explains analysis of components used in design and principle of operation.

Chapter three deals with stages undergone during the construction process, system testing and discussion of results.

Chapter four contains recommendation with respect to the result achieved and future improvement and conclusion based on result achieved during the project work.

1.5.0 ON – LINE AND OFF – LINE CONCEPT

UPS can be categories into on-line and off-line concepts based on the mode of operation.

1.5.1 ON-LINE CONCEPT

The on-line UPS is a system which the inverter is always at work whenever the system is under operation whether the main power is on or off.

It takes in raw power A.C input and converts it to DC and to the AC via inverter and supplies the load.

The load is essentially isolated from the raw power supply input the back up is provided by an internal battery, which is connected to the inverter of the battery, which is connected to the inverter of ups when the input power fails. The battery can maintain the fully rated load for ten minutes, but the period can be more than ten minutes if higher load is connected.

The advantage of the design is that the components are over stressed since the inverter and charger are constantly at work whenever the system is use.

The block diagram of on-line is shown below.

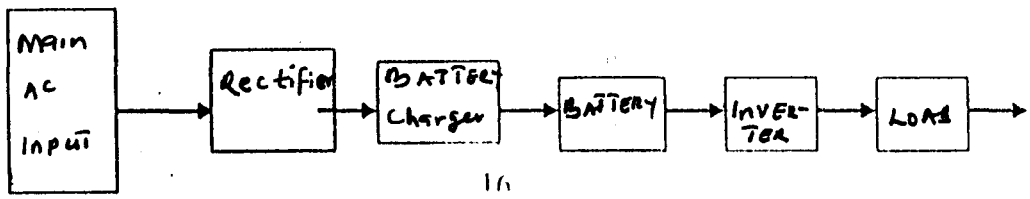


Fig. 1.5 Block diagram of on – line U.P.S System

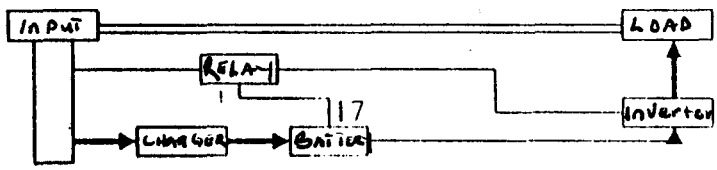
1.5.2 OFF-LINE CONCEPT

The off-line is a system in which during mains AC inputs power feeds the load directly via the filter and when the mains AC inputs fails the unit switches to inverter mode which convert DC from battery to AC and use it to feed load.

When normal mains input supply is back, the UPS automatically starts up with a aid of a relay switch and the battery starts charging up immediately for further use. The off-line design has great advantages over the on-line.

The advantage of this off-line concept is that it has the ability of supplying power to the load. Also the components is not over stressed as that of on-line which is that raw mains supply with detrimental influences is supply to the loads, which can cause damages to the load.

The block diagram is shown below.



CHAPTER TWO

SYSTEM DESIGN

2.1 VOLTAGE REGULATOR

This is positive voltage regulator that maintain a regular voltage at it's output, the fixed voltage regulator has an unregulated D.C input voltage applied to one unit terminal or regulated output DC voltage from a second terminal, with the third terminal connected to ground. This type if voltage regulator allows 1.5 fit load current if adequate heat sink is provide. The purpose of the heat sink is to absorbed heat generated due to the internal power dissipation's, current drawn by the power supply load may have a wide range of values. In addition, the temperature put voltage. A regulator is normally connected between the filter and the load. designed to maintain a nearly constant output voltage for anticipated various in the input voltage, the load current and temperature.

An important figure of merit is the voltage regulation. It is defined as the percentage charge in the output resulting from a specified charge in either the input voltage or the load current.

INVERTER SWITCHING

2.1.2. This is important parts of inverter where the battery D.C voltage is being chopped to obtain AC equivalent voltage. To accomplish this, the use of flip-flops is employed. The flip-flops has two output and clock, the input signal are J.K and also two output are $Q,\overline{Q}$. the source is connected to the Darlington pair – transistor where the emitter of one is directly joined to the other. To obtain balance circuit the sources have been return to ground and is connected to the centre tap of the primary transformer.

Since the two different pulses generated are alternating, it means that when Q is ON $\overline{Q}$ is OFF, the Q

pulls the battery potential connected to the transformer centre – tap to earth, resulting in an upward swing. As soon as the first pulse goes to zero the second pulses goes high triggering on Q and turn off $\overline{Q}$. Q in also pulls the battery voltage down to earth to obtain a second downward swing. This two swing on getting to the transformer are coupled together to obtain a square wave whose peak to peak voltage is twice the battery's potential.

Fig. 2.1 shows the circuit design for inverter circuit

2.1.3 PUSH AND PULL SWITCH

Push and pull switch is use to switch ON and OFF the circuit. If it is pull i.e On the circuit will start working, but if it is pull i.e OFF the circuit will stop working but the battery will continue charging, it doesn't affect the charging of the battery.

2.1.4 TRANSFORMER DESIGN

The transformer is responsible for coupling the swings for the switching transistor together to get a low

voltage AC at the transformer. It also steps the low voltage up to 230V at the transformer secondary. The size and the coil gang of the transformer suggest it's power handling capability.

Well in this project, the transformer is designed to power wad of 600VA.

Battery voltage = 12V

Peak to peak value at the primary coil is 24V.

Vr.m.s = o0.0707 x 24 = 16.8v

At secondary winding

500/24 = 2.08A

So, the wire guage that can stand this current from magnetic wire specifications ANG. This gange will support maximum current of 2.08A.

Gange ANG 17 was used on secondary winding

E_2 = 200V E_1 = 16V

Number of turn per unit volt = 8 turn/volt.

$N_2/N_1 = E_2/E_1 = I_1/I_2$

Where N1 = primary turns

N_2 = Secondary turns

E_1 = Primary voltage

E_2 = Secondary voltage

I_1 = Primary current

I_2 = Secondary current

2.1.5 DARLINGTON PAIR TRANSISTOR

It is the name given to a pair of similar transistors so connected that emitter of one is directly joined to the base of the other as shown in fig. 2.1 (a) obviously, the emitter current if Q1 becomes the base current of Q2.

Darlington pairs are commercially mounted in a single package that has only these lead; base, collector and emitter as shown in fig. 2.1 (b) it often forms a double CC stage in multi stage amplifiers. It is so equivalent to two – cascade emitter follower.

MAIN CHARACTERISTIC

(i) Current gain

It can be proved that current gain of Darlington pair is

$(1 + B1) +$

$(1 + B2) = (1 + B) = (1 + B)^2 \approx B^2$

If the transistors are identical

$B_1 = B_2$

Proof

$1\ ß2 = 1E.\ 1 = (1 + ß1)$

$1E.2 \approx ß.2 = ß1\ ß\ 1\ ß.1$

$Ai = IE.2/1\ ß.1 = ß\ 1\ ß\ 2 = ß\ 2$

It means that a Darlington pair behaves like a single transistor having a beta of ß

ii. **INPUT IMPEDENCE**

In fig. 2.1 (a). The input impedance seen from the base of Q2 is $ri.2 = ß2\ (re.2 + RE) \approx RE$

Input impedance is as seen from the bases of Q2 is $ri.\ 1 = ß1\ (re.1 + ri.2) = ß1$

Re.1 + ß1ri.2 ß1 re.1 + ß2 RE ≈ ß1 ß2 RE or rm (base of Q1 = ß2RE.

NOTE: If there is a load resistance RL couples to the emitter of Q2, then ri.1 – $ß^2$ (RE//RL) = $ß^2$ rE.

As seen, load impedance RE has been transformed into $ß^2$.RE obviously, a Darlington pair is capable of high input impedance. In fact, whehever a load cause severe loss in voltage gain (loading effect), it is usually to step up load impedance via a FET stage, a single CC stage or Darlington pair when much greater impedance transformation is required.

(ii) **VOLTAGEGAIN.**

A = re/Re + RE = 1/1 + re/RE ≈ 1

ADVANTAGE OF DARLINGTON PAIR

1. It has normous impedance transformation capability i.e it can transform a low - impedance load into a high impedance load. Hence, it is used in a high-gain operational

amplifier which depends on very high input impedance for it's operation as an amplifier.

2. It was very few components.

3. It provides very high ß – ß value.

2.1.6 TLC 555 TIMER

As the name implies, TLC 555 timer are use as a timer in various electronic instruments. TLC 555 timer fabricated through complementary Meta oxide semi-conductor (Cmos) process. It is capable of producing accurate time delay and oscillation due to it's high input impedance.

TLC555 timer can be used as monostable or bistable in any circuit depending on the ways the resistor and capacitors are connected to it. It can be monostable one resistor and [illegible] one capacitor while estable more than two resistor and capacitor.

The Cmos process allows the TLC 555 operated at the frequency up to 2 MHz. It also consume very low power typically 1MW at Vcc = 5V over a wide range if supply voltage ranging from 2VRE 18V. this is now the output pulse is been generated TLC 555 timer.

2.2.1 CONTROL SIGNAL GENERATION

The driver switching signal was generated using TLC 555 timer as an estable multivibrator.

At the time interval when the capacitor C charge from 1/3Vcc the output is high, the time interval is given by

Tmqh = 0.695 (RA + RB)C.

The most output is low when capacitor discharges from 2/3 Vcc and the time interval is given by T low -= 0.695RB.C therefore, the oscillation period 'T' is given by T = T high + T low = 0.695 (RA + RB) C + 0.695 RB.C. The frequency of the oscillation F is given by F = 1/T

= 1.44/(RA + 2RB)C

Well to obtain the frequency of 100Hz at output, the flip-flop divided by two (2) help us to divide the frequency by 2 to obtain 50Hz at the first half circle, equal to second half cycle.

The value of the RA is chosen to be 1k while RB value is chosen to be 14kΩ. The capacitance of the capacitor C is as follows:

$F = 1.44/(RA + 2RB)C$

$50 = 1.44/(1000 + 2 \times 14.000)\ C = 1.44/(29,000)C$

$C = 1.44/\ 50 \times 29,000 = 1.44/145,000$

$C = 0.000000993F$

$C = 0.993\mu f$

Fig. 2.2 below is a circuit design of control signal generation.

2.2.2 FILTER DESIGN

A filter is a circuit that separates signals at specific frequencies. There are many filter designs for example, they may be designed to pass low frequencies and reject

high frequencies, to reject low frequencies and pass high frequencies; to either pass or reject specific frequencies band.

In this project, the filter needs to pass low frequency, yet decrease the high frequency currents. This filter is called a low-pass filter. The circuit has a resistor or an inductor in series with the signal voltage. And it also has a capacitor in shunt or across the link.

As the frequency is increased, the reactance of I increases so large an amount of voltage appear across L. Also as frequency increases, the reactance of C decreases.

In a network of RCL circuit, there is a frequency at which Xc = XL. Since XL increases as frequency increases, there is one frequency at which they are both equal. This is the resonant frequency of the circuit or fo. This particular circuit frequency may be figured using the resonant formular.

$$Fo = 1/2\pi\sqrt{Lc}$$

This formular is aimed at using the following steps at resonance XL = Xc or $2\pi fL = 1/2\pi fc$.

$F = 1/(2\pi)^2 fLc$

$F^2 = 1/(2\pi)^2 fLc = 0.159/\sqrt{LC}$

For frequency of 50Hz and choosing an arbitrary value of 22Nf and calculating for L.

$= 50 = 0.159/\sqrt{22} \times 10\text{-}6 \times L.$

$L = (0.00318)^2/22 \times 10^{-6} = 0.46$

$= 460MH$

2.2.3 BATTERY

The sealed lead – acid battery type used in this project was chosen on selectively basis rather than on an actual design. However, the performance expectations and specifications of the battery must be known. A typical UPS battery must have the ability to store energy within a small space and with least weight and to release it at an adequate rate for the purpose under consideration.

The reasons for choosing a lead – acid for this project are (i) its voltage on discharge is the highest of all. Others

(iii) It can operate satisfactory over wide range of temperature.

2.2.4 BATTERY CAPACITY

The ability of a battery to produce a current over a certain period of time is its capacity. The amount of energy a battery can store is measured in ampere hours (AH) at a specified discharged rate. The capacity reduces as the rate of discharge increases. For example, a battery of 60 ampere hours capacity will provide 6amps for 10 hours before reaching the point at which it is considered to be discharged. The capacity of the used is 7AH.

2.2.5 12V BATTERY CHARGER

The battery charger module consists of a step down transformer, a variable regulator Lm 317 and bridge rectifier unit.

For lead – acid batteries each call provides two watts. Thus a 12v battery of this type consists of six cells connected in series. The fixed "float" voltage is between 6 x 2.3 = 13.8v and 6 x 2.4v = 14.4v. The higher value will be chosen, since this means a faster charging rate. This is desirable in a situation where the frequency of blackout is high.

The step-down transformer steps-down the a.c mains to 15 Va.c and a bridge rectifier consisting of four ~~zener~~ diodes is used to connect the main a.c to d.c. This voltage is regulated to zine using variable regulator LM 317.

Fig. 2.3 is the circuit diagram for 12V Battery Charger

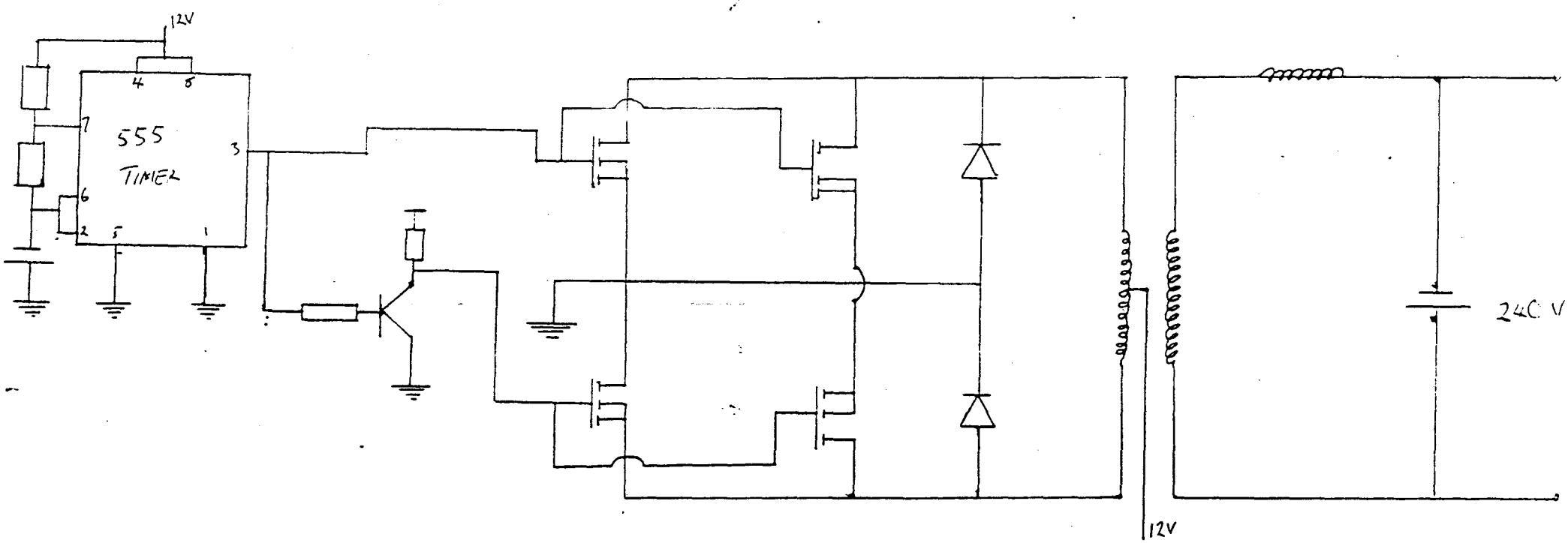


Fig. 2.1 INVERTER CIRCUIT DIAGRAM

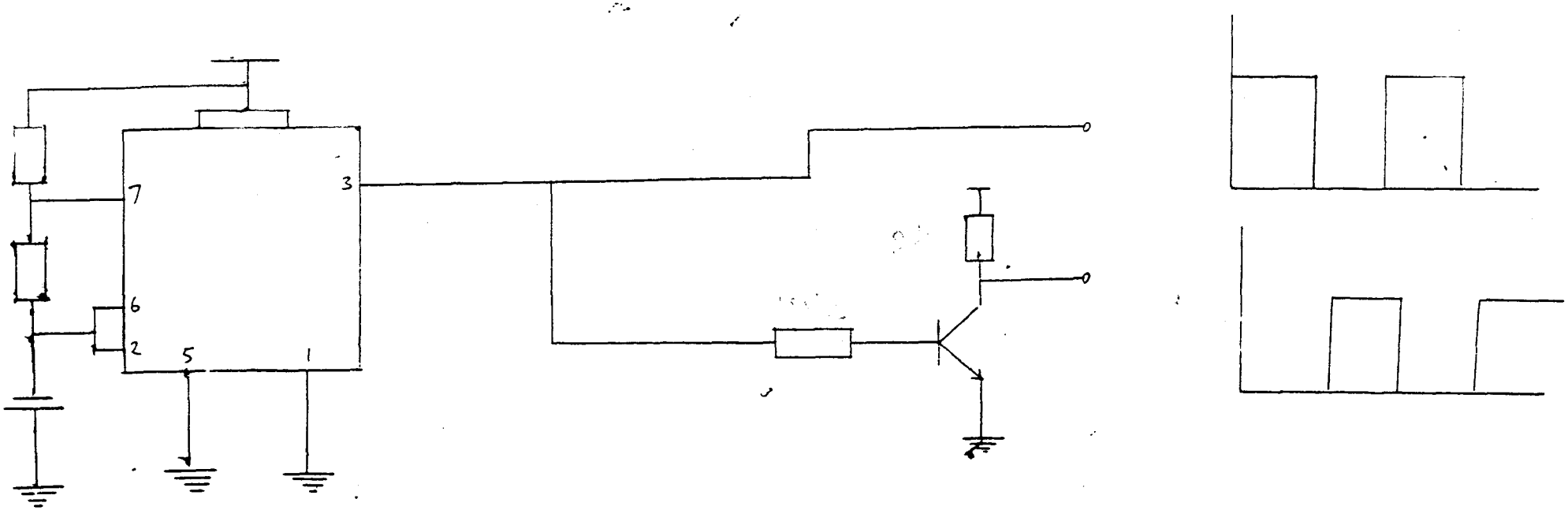


Fig. 2.2 CONTROL SIGNAL GENERATION CIRCUIT

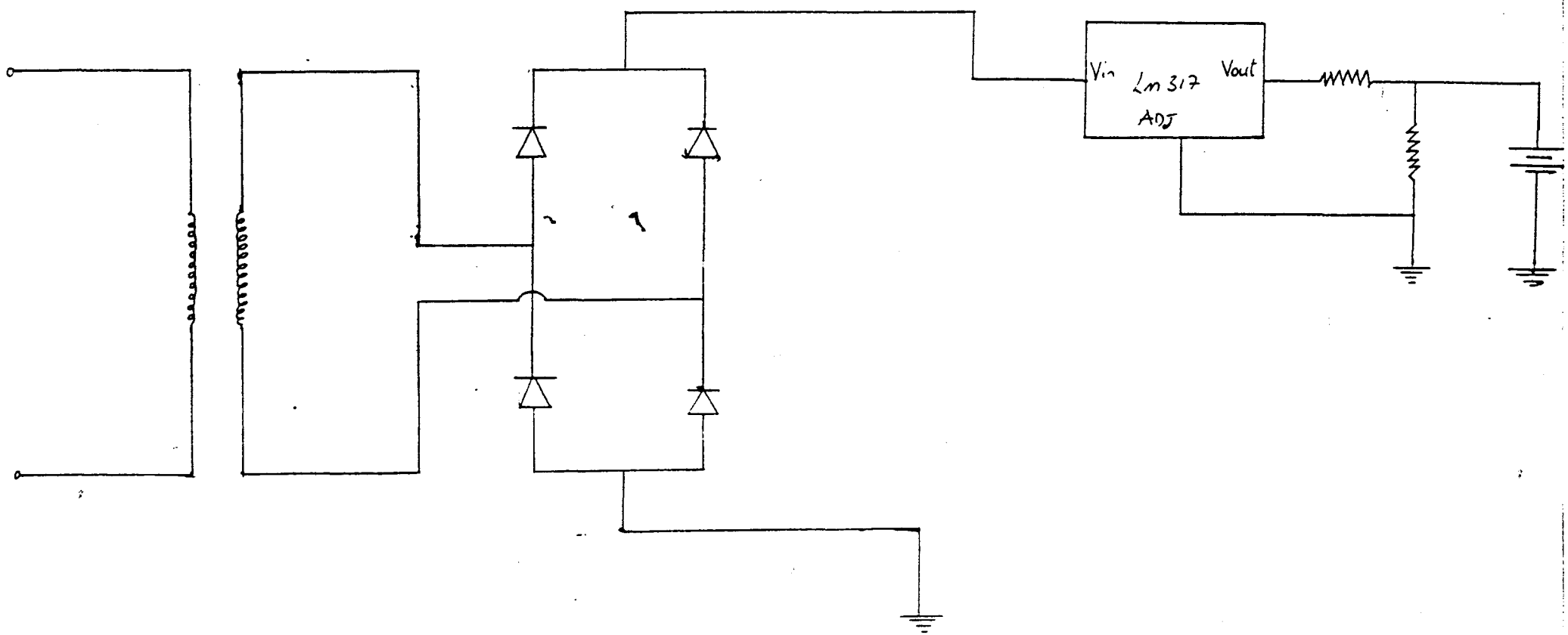


Fig. 2.3 12V BATTERY CHARGER

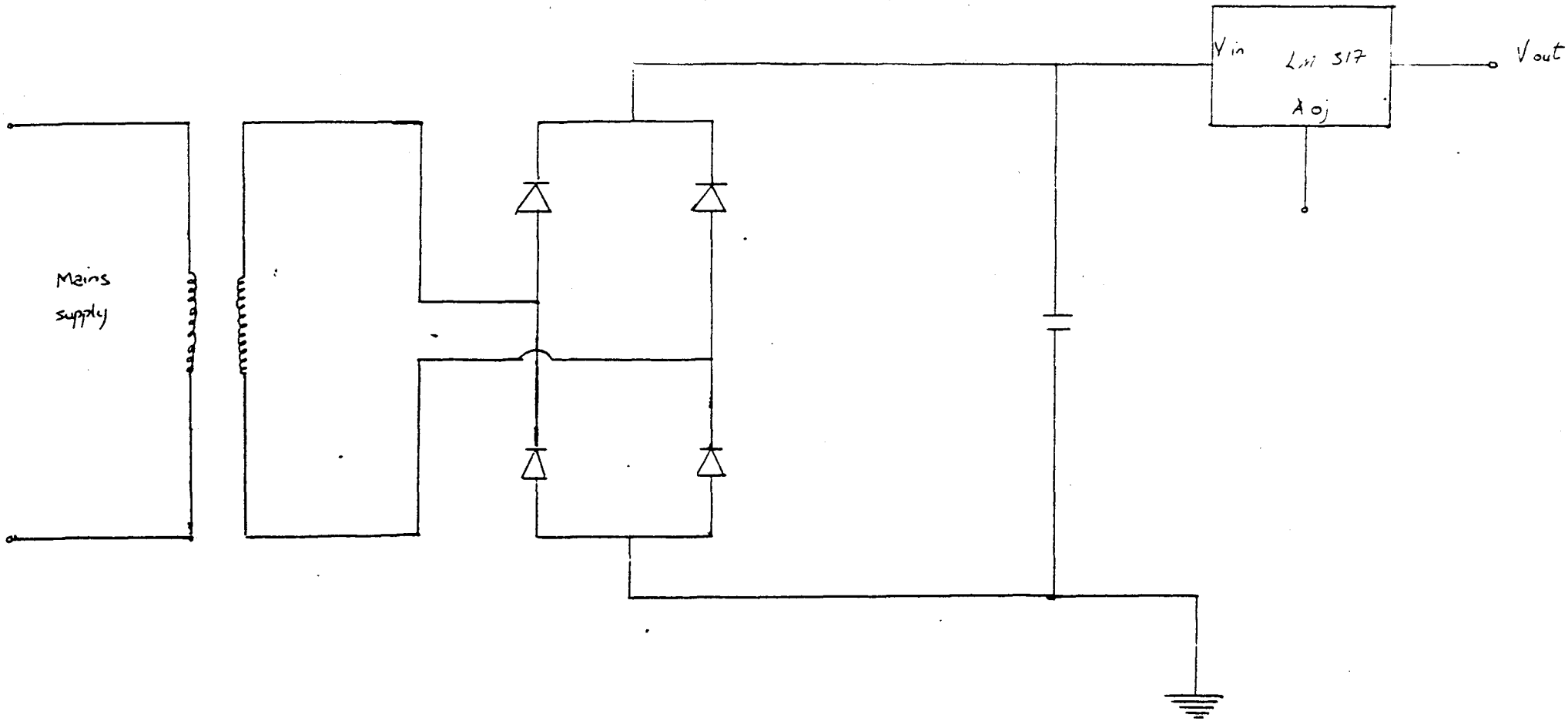
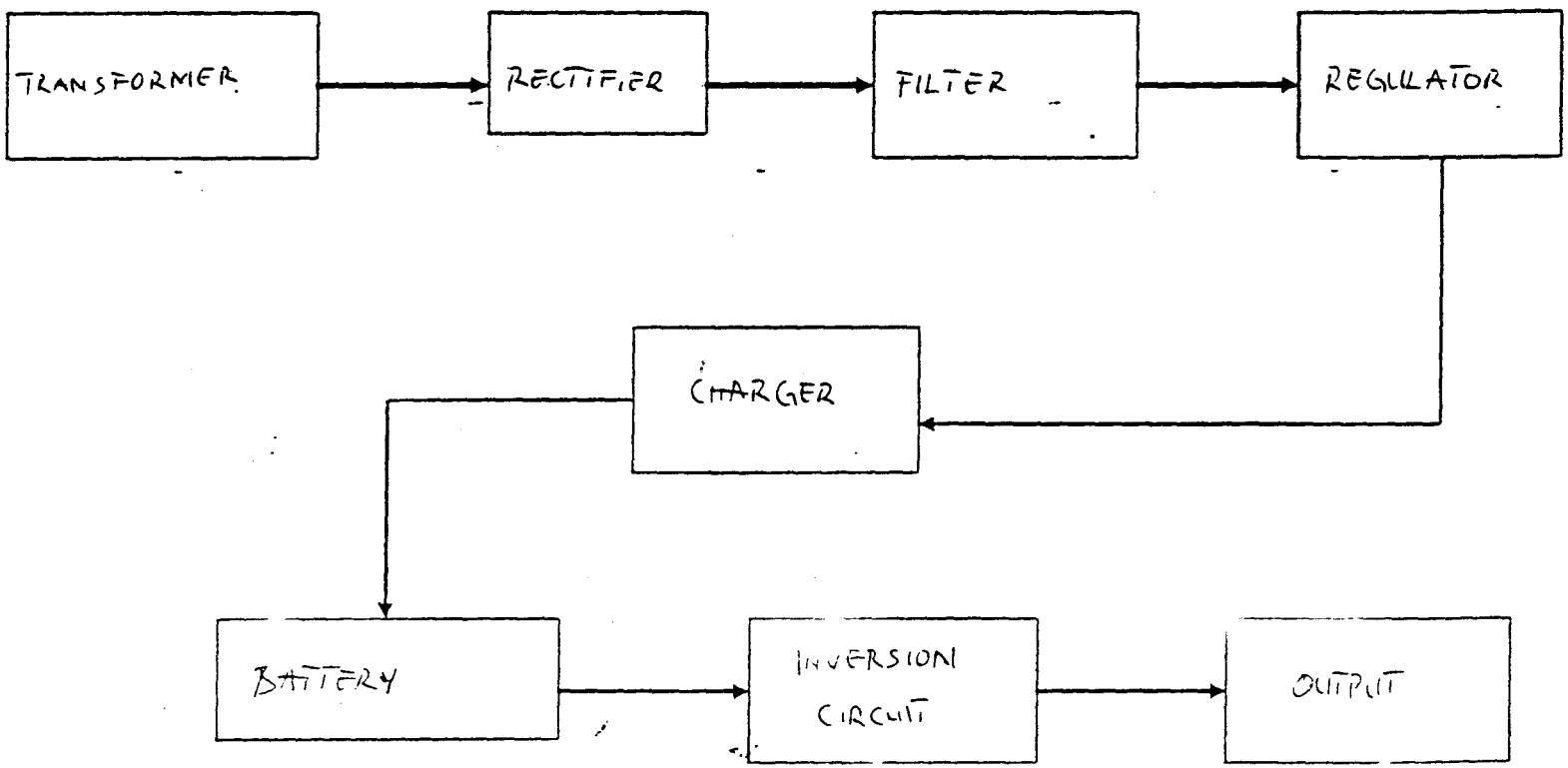


Fig 2.4 POWER SUPPLY CIRCUIT

BLOCK DIAGRAM OF AN UNINTERRUPTED POWER SUPPLY SYSTEM.



CHAPTER THREE

3.0 CONSTRUCTION, TESTING AND RESULT

3.1 CONSTRUCTION AND SYSTEM TESTION.

After completing the design stage of the system, each module sub-system circuit diagram was first implemented on a bread-board to sure it works as desired, various aspect of the system was modified to obtain desirable working and stable circuit before it wa permanently constructed on the Vero – board. However, not all the subsystems would require very through and rigorous test as others. Some are very vital and need to be pre-set to a certain specification before proper operation can be obtained.

3.2 CONSTRUCTION STEPS.

The following steps were taken in carrying out the construction.

(i) The circuit was first tested on a breadboard, and few adjustment and modification were made on the circuit.

(ii) The layout plan of the component position on the Vero-board was made, unnecessary distance between components were also avoided to reduce the length of wire used and have reduced overall circuit capacitance and resistance.

(iii) Ic sockets were then soldered unto the Vero board in places assigned to them in the layout.

(iv) The copper strips on the Vero board were then disengaged appropriately to avoid unwanted connections.

(v) The discrete components – resistors, capacitors and transistors were soldered directly to the Vero-board.

(vi) The switching transistor were then mounted on their heat sink

(vii) Installed component were then connected to one another using wires in accordance with the design.

(viii) A digital meter was used to check the contacts and continuity where necessary.

(ix) With the ICs plugged into their sockets, the circuit was then ready to be rested.

(x) The output of each stages of the sub-system unit was tested to see the meet the target before coupling them together.

3.3 SYSTEM TESTION

The system having been fully constructed was tested as described below to check if it is responding as expected. The testing was done using the following appropriate tools.

(i) Logical probe

(ii) Oscilloscope

(iv) Digital meter

(v) AC variable power supply

(vi) Dc Power supply

(vii) Variable load (watts)

(viii) Screw driver (i.e tester)

3.4 TESTION PROCEDURE

The most appropriate way to test the UPS system is to perform a step-by –step modular subsystem test. Each of the modules are as earlier specified.

However, not all the subsystem would required very thorough and rigorous test as others. Some are very vital and need to be pre-set to a certain specification before proper operation can be obtained.

In the charging circuit, the transformer output was measured to an AC before rectifying and filters off ripple. The light emitter diode (LED) was used to ensure that the charger is properly connected. The resistance of the resistor was verified by using ohmmeter.

Finally, the output of the inverter circuit with the relay network was tested on no load and then output measured to be 230V.

CHAPTER FOUR

CONCLUSION AND RECOMMENDATION

4.1 CONCLUSION

The design and construction of 600w UPS has been successfully carried out.

The use of power FET greatly reduced the problem associated with commutation and driver stages. A 555 timer was sufficient to drive the low power requirement FET gapes.

The components used were common types. No complicated circuit was used and the mode of operation was easily understand. But number difficulties were encountered during the design and construction due to little knowledge known about the project. But constant research into reference books, electronic journal and suggestion from friends and project only put the basic principle behind circuit design and construction.

RECOMMENDATION

I recommend whoever wants to take up this topic as a project to make some advancements in areas as follows:

1. Due to the rather poor condition of power supply we receive here in this country (with tolerance as bad as ± 25% as against developed nations with tolence of 15%), more allowance have to be made for the power transfer line-loss detection circuit to cope with such a problem.
2. The power rating of those device can be increased for bigger loads
3. A means of synchronizing the inverter output voltage with the utility voltage before switcher should be examined. This important for a smooth transfer to avoid transient.
4. In comparating a feedback wap, which will make the output voltage a constant.

REFERENCE

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