DESIGN AND CONSTRUCTION OF A 12V AND 24V AUTOMATIC SHUT OFF BATTERY CHARGING DEVICE

BY

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93/3713

A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B. ENG) DEGREE

IN THE
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NIGER STATE.

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CERTIFICATION

This is to certify that this project titled Design and construction of a 12V and 24V automatic shut off Battery charging device was carried out by Ukandu K. C. (93/3713) under the supervision of Mr Paul Attah and submitted to Electrical and computer Engineering Department, Federal University of Technology, Minna in partial fulfillment of the requirements for the award of Bachelor of Engineering (B. Eng) degree in Electrical and Computer Engineering.

Mr. Paul Attah Project supervisor	24/03/2000 Date
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DEDICATION

This project work is dedicated first to the Almighty God for His goodness and Kindness, to my beloved Parents Engr, and Mrs. K. N. Ukandu, to millions of suffering Africans and then to the entire students and members of staff of the department of Electrical and Computer Engineering, Federal University of Technology Minna, You have all been wonderful.

ACKNOWLEDGEMENT

First and foremost I give thanks to God for giving me wisdom and the life to finish my academic programme. Also my gratitude goes to the following people for their steadfast support and encouragement, Mr Parents, Engr. And Mrs K. N. Ukandu and all my siblings, Dr Y. A. Adediran my head of Department.

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Finally all my friends, who saw the light at the end of the tenure with me.

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ABSTRACT

This particular project describes the design, construction and testing of a "12V & 24V battery charging device" A particular reference is made to lead acid battery used by car owners.

The accomplishing factor of this project are the abilities exhibited at full charge which includes switching off the supply to the battery on charge, and giving visual indications.

The theory, circuit design, analysis, block diagram and circuit diagram with values are provided to give adequate and precise information about the design. The circuit was assembled, tested and confirmed working satisfactorily.

CHAPTER ONE

INTRODUCTION

A device that stores chemical energy (not electricity) and bring about a reaction between these chemicals in a say to cause electrons to flow through an external circuit is known as a battery. There are two types of batteries, the primary and secondary battery.

The primary is the one that is not capable of yielding any more electric current when the active materials has been used up that is it can not be charged while the secondary battery can be restored to their original chemical state when the battery has been used. There are different types of secondary batteries. These are lead acid, Nikel-cadmium and silver zinc.

The maintenance of secondary batteries is of importance particularly where minimum performance and life are to be obtained.

Since we know that after using a secondary battery for many hours. It will become weak, because of this, so a battery charging device which is low cost, highly efficient and cheap to maintain is needed to restore the energy that has been used back, so that the battery will be ready for use anytime it is needed..

Charging has a profound effect in this regard and several good method have been developed.

The constant current method simply returns the energy that has been discharged when in use at a fixed current for a fixed period of time, but it has the disadvantage that it is too slow at the beginning of the recharge (when the battery can accept charge sufficiently) and fast towards the end of recharge (when the battery can accept charge only slowly) which leads to a wasteful recharge that can damage the battery.

The regulated constant potential procedure is used in this project work in which the alternating voltage from the mains is converted to direct voltage with filtering capacitor to remove the ripple voltage and the voltage regulator is connected to supply constant voltage of 14.4 and 28 V. This method not only turns out to be efficient in terms of time and cost but also in the avoidance of over voltage supply which can damage the battery.

1.1 AIMS AND OBJECTIVES

1. The aim of this project is to design and construct a low cost battery charging device.
2. To charge a 12V and 24V battery with particular reference to lead-acid battery due to its availabilities.
3. To avoid over charging which can destroy the cells operating below capacity of the battery.
4. To provide visual indication of dull charge (GREEN LED) and while charging (RED LED).

1.2 LITERATURE REVIEW

It took approximately 50 years from the time of volta's invention of the galvanic cell principle in 1800 for its application to the land/sculpture aicd/lead dioxide system by siemens and sinstedem. Barely 10 years later, this was followed by Planke's invention introducing the lead acid battery as an electrochemical storage device.

For his contribution, Planke's name was incorporated in to the permanent lead acid battery terminology with reference to the so called plank's plate. These plates have their active materials layer or surface formal electronically from the lead substrate rather than applied to the substrate in a separate operation.

Planke's cell consisted of leads sheet wound spirally in a cylindrical configuration and separated by rubber strips, heavy liner or felt Pb/Po2. This development progressed systematically till the present day. A significant development was achieved towards the end of the nineteenth century by Faure. He utilized pasted plate structure consisting of active materials mixed, applied to a variety of lead current collector configurations. Increasing usage were found among the various types of separators starting with such "exotic" materials as flannel.

In the advert of a more technological era, with dynamics available for battery charging and electric motor for the utilization of discharged energy, marked a gradual acceptance of the advantages of re-chargeablillity in general and of the lead acid battery in particular.

By the year 1900 sufficient types of lead acid batteries have been developed. The world war II brought about new development and improvements in the field, including new raw materials for the construction of separators and battery case as well as the new methods of manufacturing of all internal components of the battery. Also additional types of grid alloys for various applications, improved active materials, composition, formulations and processing techniques etc. Progress had been made lately in all these areas thereby resulting in product being lighter in weight and more reliable.

1.3 PROJECT OUTLINE

Chapter one gives us an insight into what a battery is like

Chapter two talks about the system design analysis, the components used. It also tells us or gives an insight into the operation of the charger, the circuit parameters are obtained using calculations and the ECG Data book.

Chapter three tells us more about the actual construction, testing and results obtained.

Chapter four talks about discussion of results, conclusion and recommendation including references.

CHAPTER TWO

SYSTEM DESIGN

2.11 POWER SUPLY UNIT

The automatic battery charging device requires a supply of d.c voltage to effect operation. Since 50HZ 240V a.c. supply is readily available in most homes, offices and workshops, it forms part of our power supply unit. In the field of electrical Engineering, It is called the mains supply. The power supply unit consist of a step down transformer, a rectifying circuit, filtering capacitor and voltage regulators 7805, LM 317T(2)

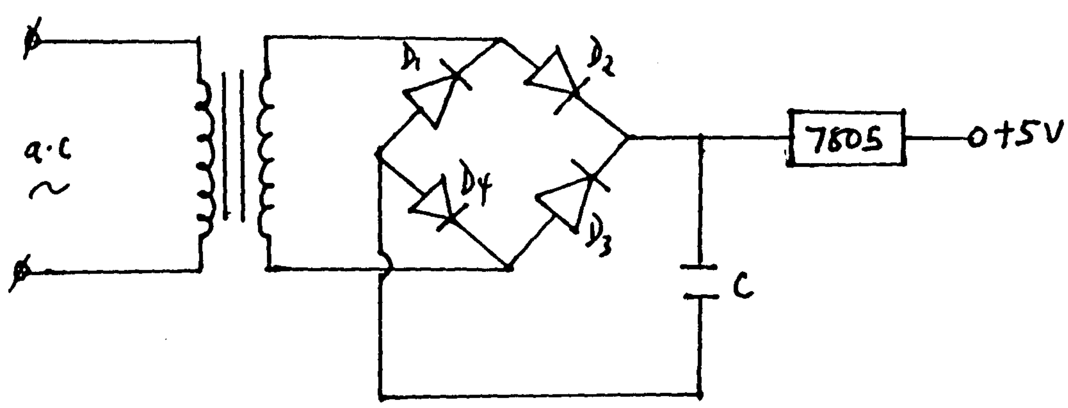


Fig 1 Power supply unit.

2.12 TRANSFORMER

A transformer is a static electrical machine made up of magnetic core and several copper windings. The windings are divided into primary and secondary windings of the transformer. The transformer is a device used to transfer energy from one circuit to another by electromagnetic induction. A transformer consist of two or more coils of wire wound around a common laminated iron core, The coupling between the coils approaches unity . The ability to receive power at one voltage or current level and deliver it at some other voltage or current level is the most unique feature of a transformer i.e transformers can be used to either step up or step down voltages and they can also be used to power the circuit that are isolated from the main power supply, and they are used in Electrical engineering for impedance matching.

The essential parts of a transformer are primary windings which energizes the coil from an external voltage while secondary winding is used to deliver power to an external load. The magnetic core is made up of laminated metal sheets stamps together to provide a high performance

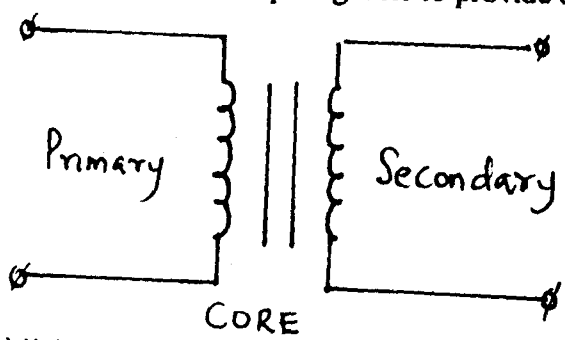


Fig 2(a) Schematic symbol of a transformer

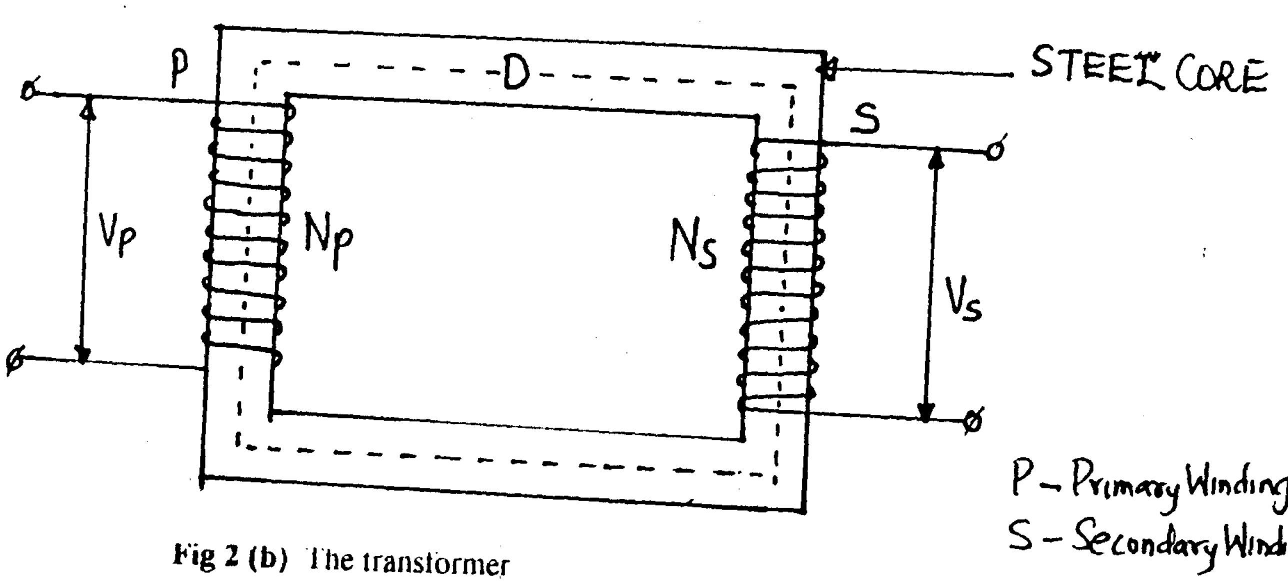


Fig 2 (b) The transformer

mathematically,

$V_S/V_P = N_S/N_P$

V_S = secondary voltage

V_P = primary voltage

N_S = Number of turns of secondary windings

N_P = Number of turns of primary winding

The ratio between the number of turns in the primary and secondary in called the TURNS RATIO

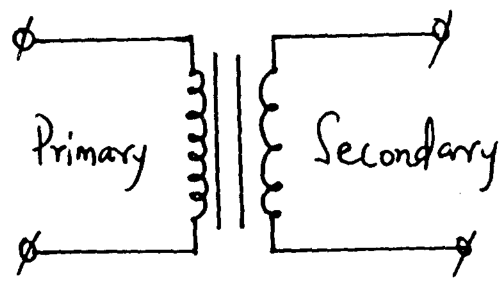


Fig 2(C). Step-down Transformer

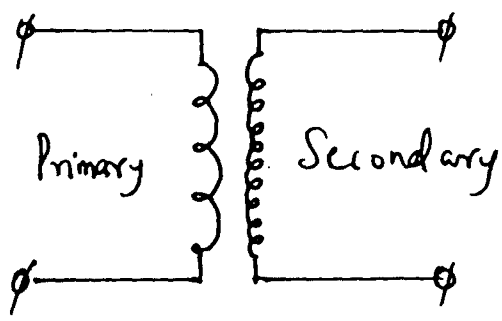


Fig 2(d) Step-Up Transformer

2.13 WORKING PRINCIPLE

When a 240V, 50HZ alternating voltage is supplied to the primary circuit, it circulates an alternating current through P and this current produces an alternating flux in the steel core. The mean path of this flux is represented by the dotted lines D in fig 2b. If the whole of the flux produced by P pass through S, the e.m.f induced in each turn in the same for P and S. Hence NP and NS be the number of turns in P and S respectively:

Total e.m.f. induced in S/total e,m,f induced in P =

N_S x e.m.f. per turn/ N_P x e.m.f. per turn =

N_S/N_P

When the secondary in an open circuit, it terminal voltage is the same as the induced e.m.f . The primary current is then very small negligible, so that the applied voltage VP in partially equal and opposite to the e.m.f., induced in P.

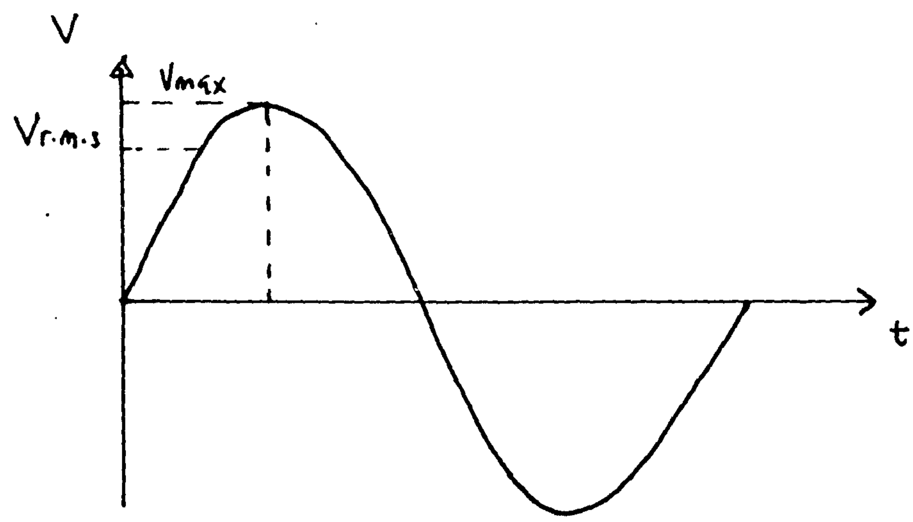


Fig 2e. Wave form of voltage variation

V.r.m.s = Vmax / 2 = Vmax / 1.414

Maximum voltage to primary winding

Vmax = 240 x 1.414 = 339.3600

Maximum voltage to secondary winding

V max = 28 x 1.414 = 39.5979V

2.14. TRANSFORMER LOSSES

Three types of losses loss along with transformer construction All loses result in heat

I COPPER LOSSES

Are the results of resistance of wire used in the transformer windings. These are also called I^2R losses. They vary as the square of current according to ohm's law and the power law

Ii EDDY CURRENT LOSSES

This is as a result of small whirlpools of current induced in the core materials. These losses are reduced by using laminated core construction. Each lamination is insulated to it bordering layers by varnish. This cuts the number of Path on which current flows

iii. HYSTERESIS LOSSES,

For molecular friction are the results of magnetic particle changing polarity in step with induce voltage, alloys and heat treating processes are used to make core materials which reduces hystersis loss

The transformer used in this design is 28v

RECTIFIER

2.15.1 DIODE AS A HALF – WAVE RECTIFIER

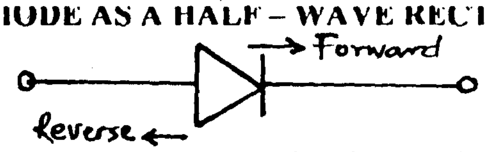


Fig 3(a)

Whilst alternating currents and voltages play the leading role in most electrical an electronic equipment, nevertheless many devices can either either operate on unidirectional current of at least they device that makes

When the applied voltage acts in the forward direction there is no voltage drop across the diode and current flows unimpeded. However, when the applied voltage acts in the reverse no current flows.

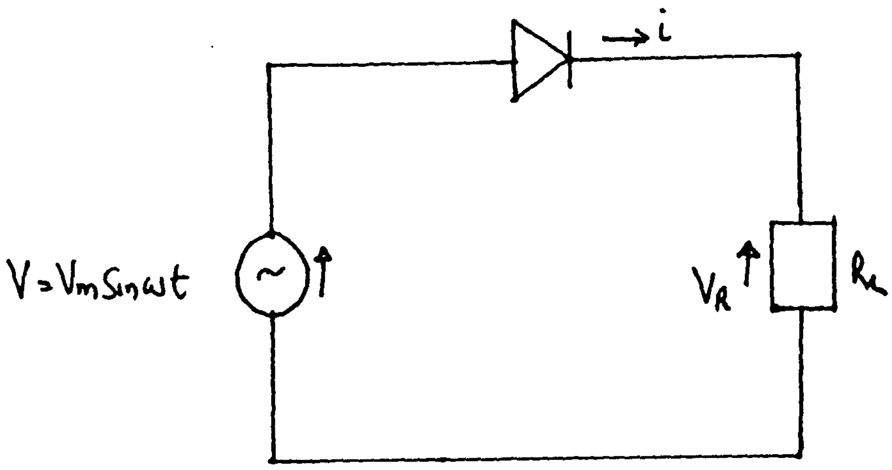
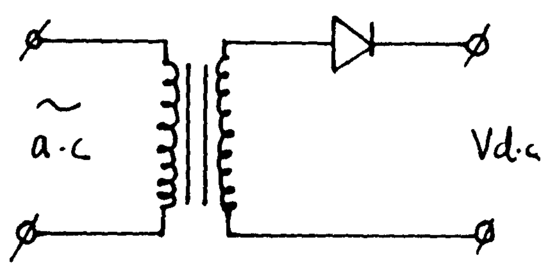


Fig 3(b) Rectification using a single diode.

It is possible to obtain rectification by means of a single diode but the current can only flow through the diode in one direction and thus the load current can flow during alternate half cycles Thus an undesirable interruption continuous current is unstable because of its high ripple factor less that 50%



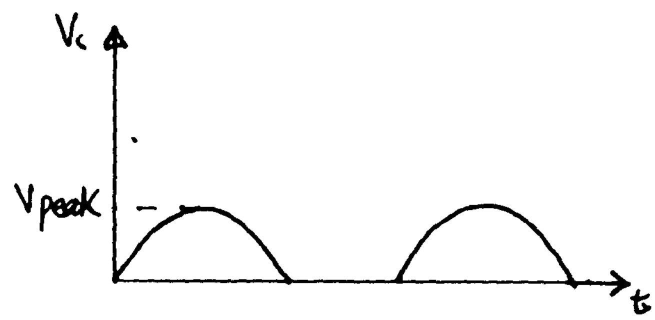


Fig 3©Half – wave rectifier circuit **Fig 3(d)** Output Wave-form

2.16 FULL-WAVE RECTIFIER USING A BREIDGE RECTIFIER

Full rectification can be done using a greater bridge rectifier which consists of 4 doides. It provides a greater d.c value from the same transformer.

When point A of the transformer secondary is positive with the respect to point B current flows through diodes D2 and D4 while D1 and D3 are reverse bias and a half-sine wave results when point B of the transformer secondary is positive with respect to point A current flow through diodes D1 and D3 while D2 and D4 are reveres bias and a half – sine wave results. Current through R is always in one direction

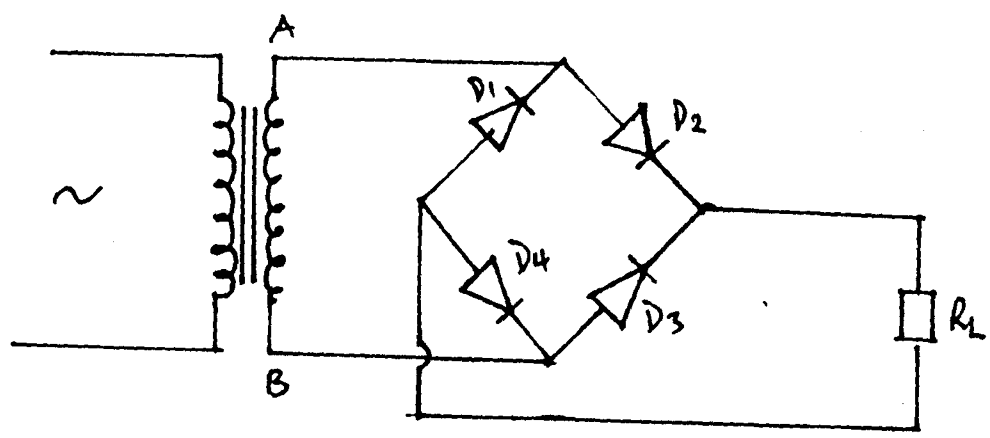


Fig 4(a) A Bridge Rectifier

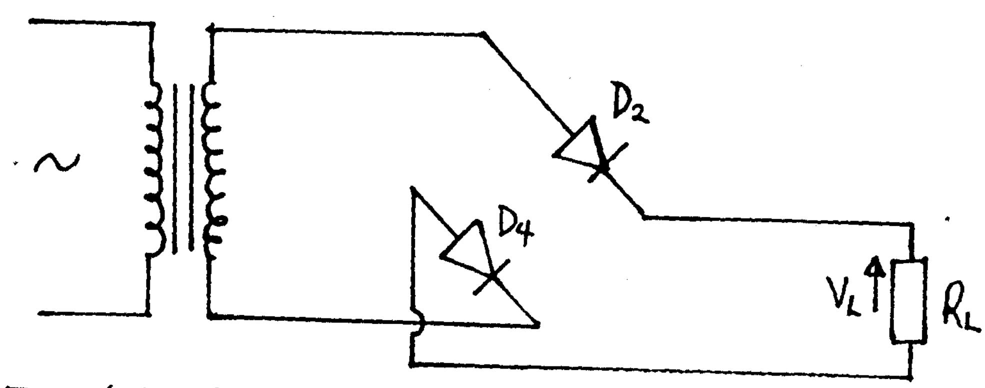


Fig 4(b) A is positwe with respect to B

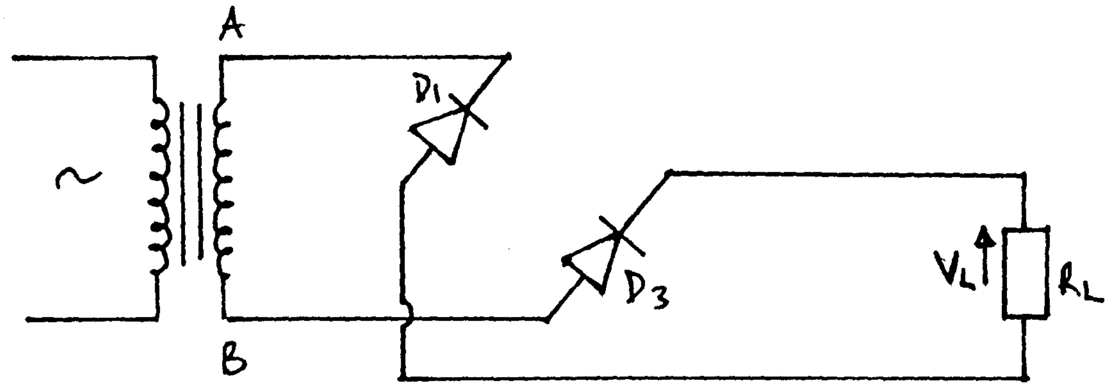


Fig 4(c) B is positive with respect to A

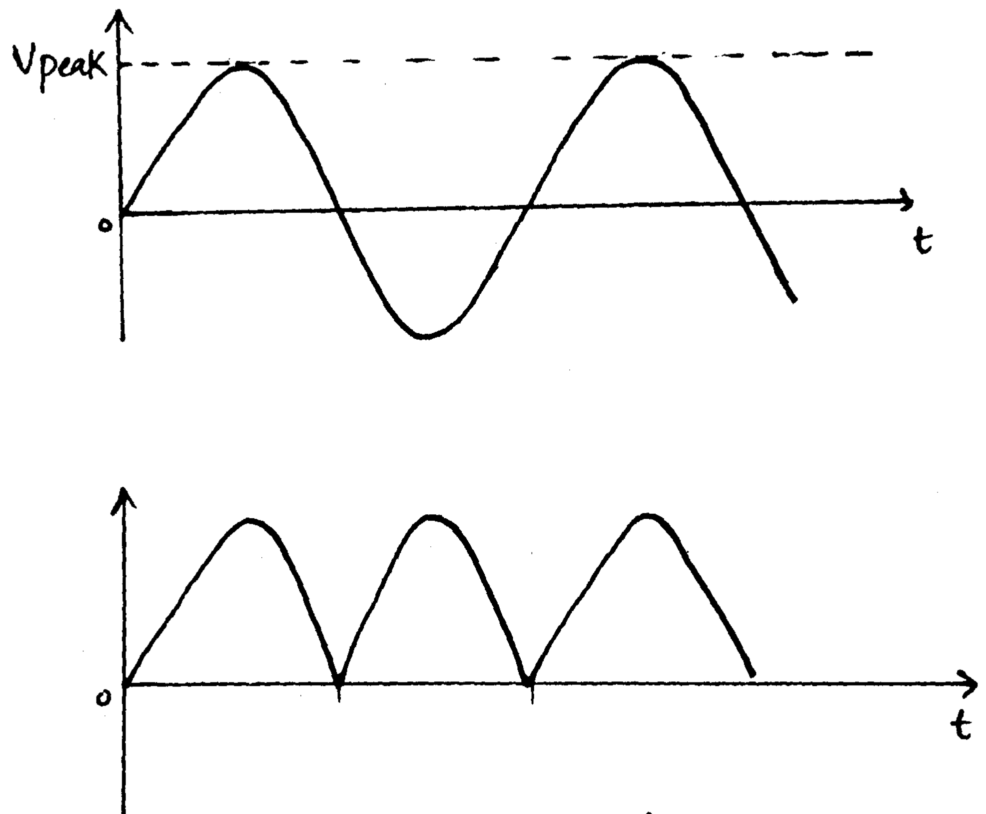


Fig 4 d Output waveform from a bridge Rectifier

2.17 SMOOTHING CIRCUIT

The output of either half-wave or full wave rectifier is a pulsating voltage. Before it can be applied to the other circuits, the pulsation must be reduced. A capacitor connected in parallel is connected across the rectifier output provides some filtering action. The capacitor is able to store electrons . When the diode or rectifier is conducting the capacitor charges rapidly to about the peak voltage of the wave. It is limited only by the resistance of the rectifier and the reactance of the transformer windings. Between the pulsations in the wave, voltage from the rectifier drops, the capacitor then discharges through the resistance of the load in effect the capacitor is a storage chamber or electrons. It stores electrons at peak voltage. It supplies electrons to the load when rectifier output is low. The capacitor used in this design work is 2200UF and the voltage is 35v.

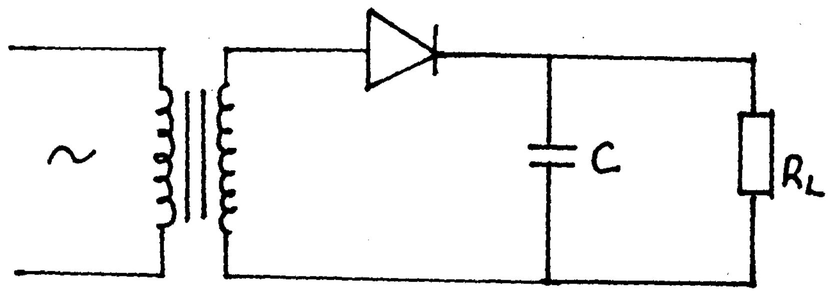


Fig (5a) Filtering circuit

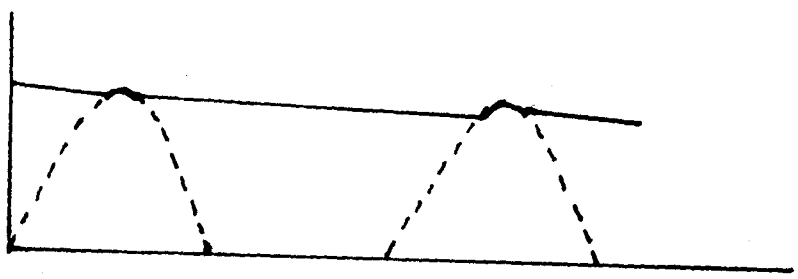


Fig (5b)

REGULATION

The secondary/primary voltage ratio is not sustained as current drawn by a load across the secondary is increased. This is due to loss of magnetic (or iron losses arising from eddy currents in the core. Current and resistive (or copper) losses caused by the resistance of the wire used in the coils.

The fall in voltage due to losses is called regulation and is commonly defined as

Regulation = Vdc max – Vdc min/Vdc max x 100%

Where Vdc max = No load secondary voltage

Vdc min = Voltage under full load current

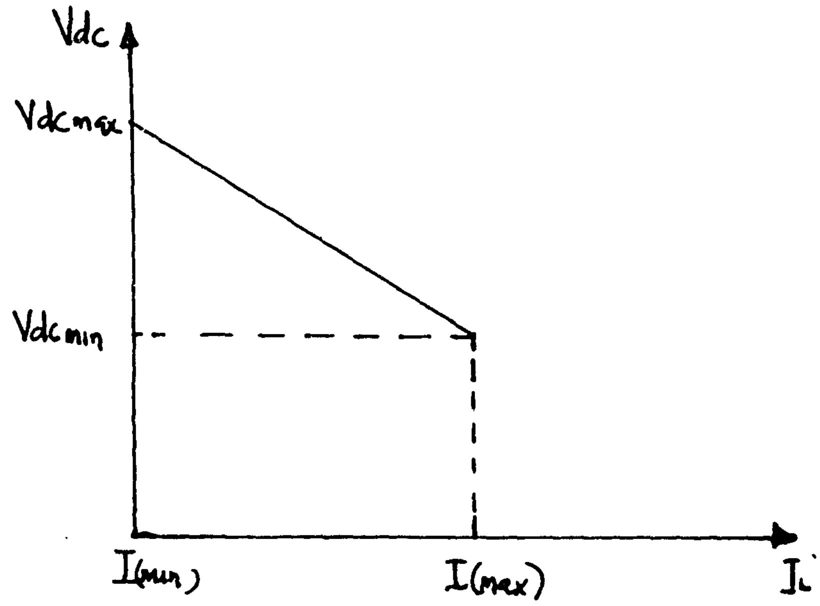


Fig 6

2.18 VOLTAGE REGULATOR

An unregulated d.c power supply may be adequate for some applications but there is usually a need for the supply voltage to be kept constant (good regulation) as well as having a low amplitude. A circuit which is called a voltage regulator connected between the unregulated supply and the load performs this functions. Stability factor(s) for a voltage regulator is a measure of the effectiveness of the regulation. The stability factor is given as

S = Vout/Vin

For a constant output Current Ii, for good regulators, S should be 0.005 – 0.002

The output resistance of a regulator should be zero ohms.

Typically Ro = Vout/Vin for constant input voltage

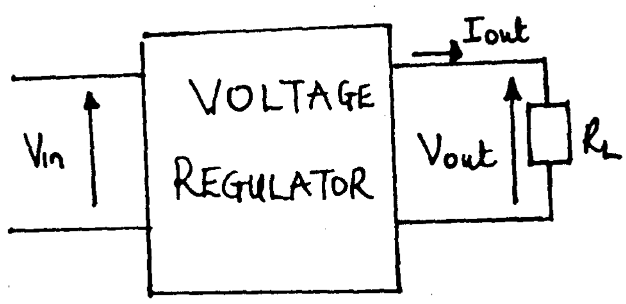


Fig 7 Shows a voltage regulator

The voltage regulators used are 7805 and (LM317T)2. The 7805 regulator provide +5v to IC's which are comparator LM311, 555 Timer and D Flip flop 74LS74

2.2 CHARGING CIRCUIT DESIGN

This consist of two voltage regulators LM 317T, transistor, resistors and a diode DXRP 608.

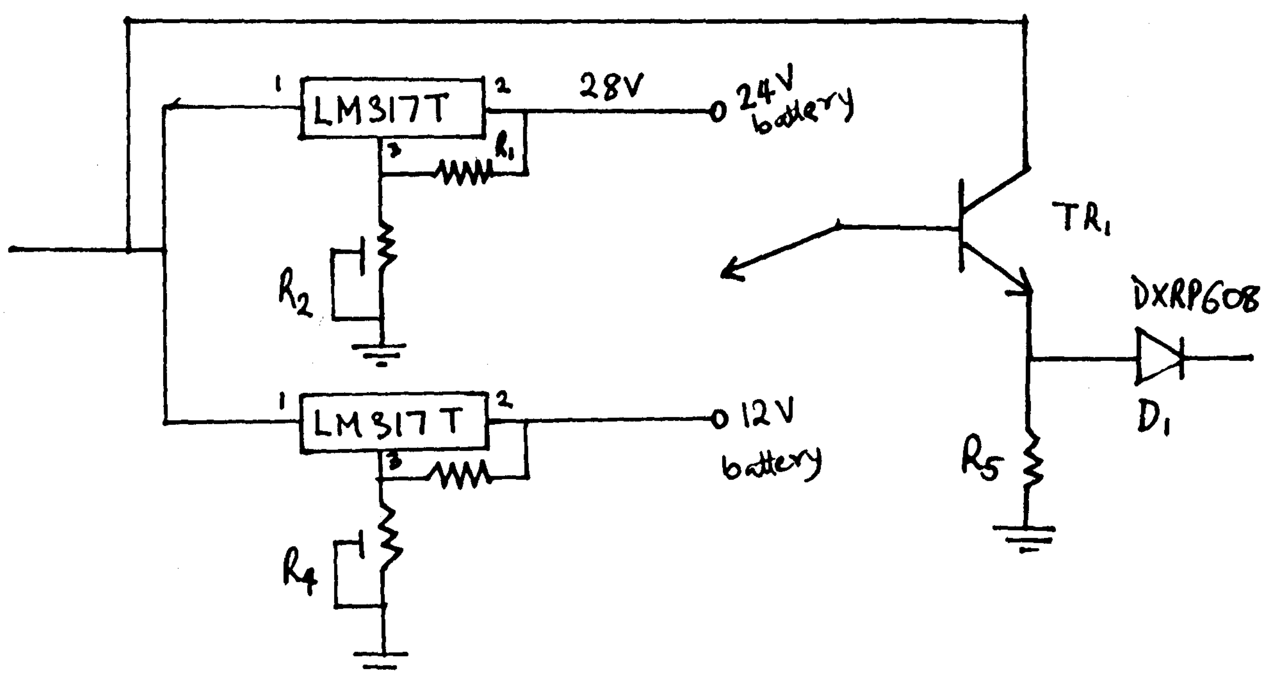


Fig 8 Charging circuit

2.21 VOLTAGE REGULATOR

LM 317T are adjustable 3 – terminal positive voltage regulators capable of supplying in excess of 3A over a 1.2v to 39v. Only 2 external resistor are necessary to set the output voltage in setting the voltage.

Calculation is involved

The LM317T is made of an external reference voltage Vref for which a typical value

Vre = 1.2v, This voltage appears across R1

Therefore

Current I1 through R1

I = Vref/R1 ....(i)

This current also flows through R2

Additional small current Iadj flows out of the adjustment terminal, the net current I2 through R2 is thus

I2 = I1 + Iadj ....(ii)

Voltage V2 across R2 is

V2 = R2 x I2 = R2 (I1 + Iadj)................(iii)

Net output voltageVout is

Vout = Vref + V2 ....(iv)

Substituting Equation (i) and (iv) we have

Vout = Vref (1 + R2/R1) + Iadj x R2 for LM317T

For this design both R1 and R3 have been made both 220ohms and R2, R4 made a variable resistor of 4.7K

Assuming an output voltage of 14.4v

14.4 = 1.25(1 + R4/220)

14.4 = 1.25 (220 + R4)/220

3168 = 1.25(220 + R4)

3168 = 275 + 1.25R4

2893 = 1.25R4

R4 = 2893/1.25

23144 = 2.3144K = R4

assuming output voltage of 28v

28 = 1.25 (1 + R2/220)

28 = 1.25 (220 + R2)/220

6160 = 1.25 (220 + R2)

6160 = 275 + 1.25R2

5885 = 1.25R2

R2 = 5885/1.2

= 4708 = 4.7K

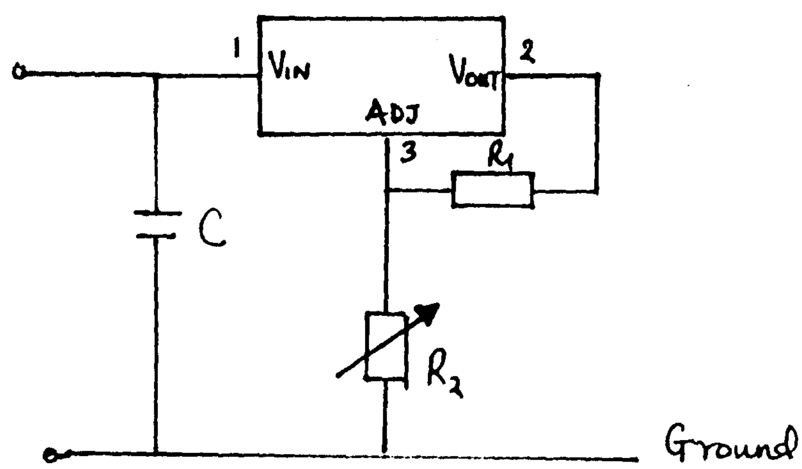


Fig 9 shows connections diagram of a voltage regulator.

2.22 POWER TRANSISTOR

A transistor is an active device capable of amplifying signals producing an output signal with more power in it than the input signal. The Unique property of a transistor when compared to other devices is its ability to provide a power gain. Thus making it possible to power for e,g a loud speaker form a transistor, observing that the output signal sounded louder than the input signal.

The transistor is basically a 3 terminal device i.e collector, Emitter and Base terminals. The figure below shows the symbol for a transistor.

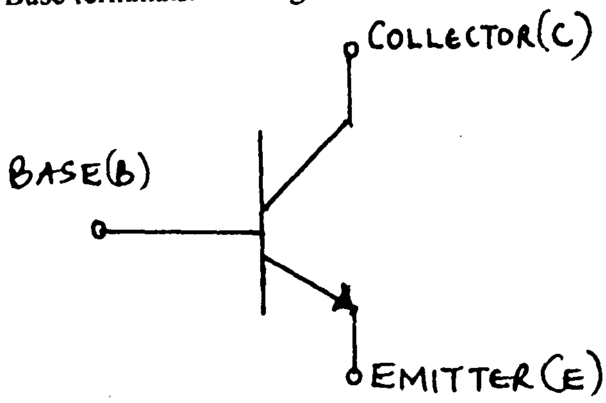


Fig 10a symbol of an NPN transistor

The transistor can be connected into 3 different modes (i) common emitter (2) common collector (emitter follower) (3) Common Base. Each of these mode possessing different characteristics. The common collector mode for example (i) also called the emitter follower because its output terminal is the emitter which follows the input (back) less one diode drop. I.e VE $\approx$ VB – 0.6 volts

Thus the output is a replica of the input but 0.6 to 0.7V less positive or this circuit, Vin must be greater than or equal to 0.6V or else the output will sit at ground. Figure 10 b below shows an emitter follows circuit.

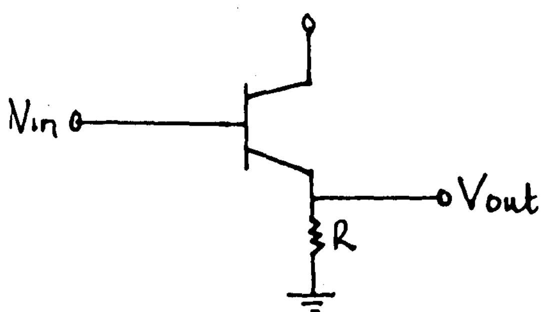


Fig 10 b Emitter follower circuit

For an emitter follower, the input impedence is much larger that the output impedance. This implies that the circuit requires less power from the signal source to drive a given load than much would be the case if the signal source were to drive the load directly.

The emitter follower therefore has a current gain but doesn't have a voltage gain.

For the purpose of this project, an emitter follower transistor 2N3772 was used to increase the charging current to the battery . The 2N3772 transistor was mounted on a heat sink to allow dissipation of heat.

2.3 CONTROL AND SWITCHING CIRCUIT DESIGN

The control and switching circuit is designed to perform the shutting off function. The circuit consist of a voltage comparator, 555 timer, D – flip flop, transistor (TR2), Resistors. Capacitor,relay and LED.

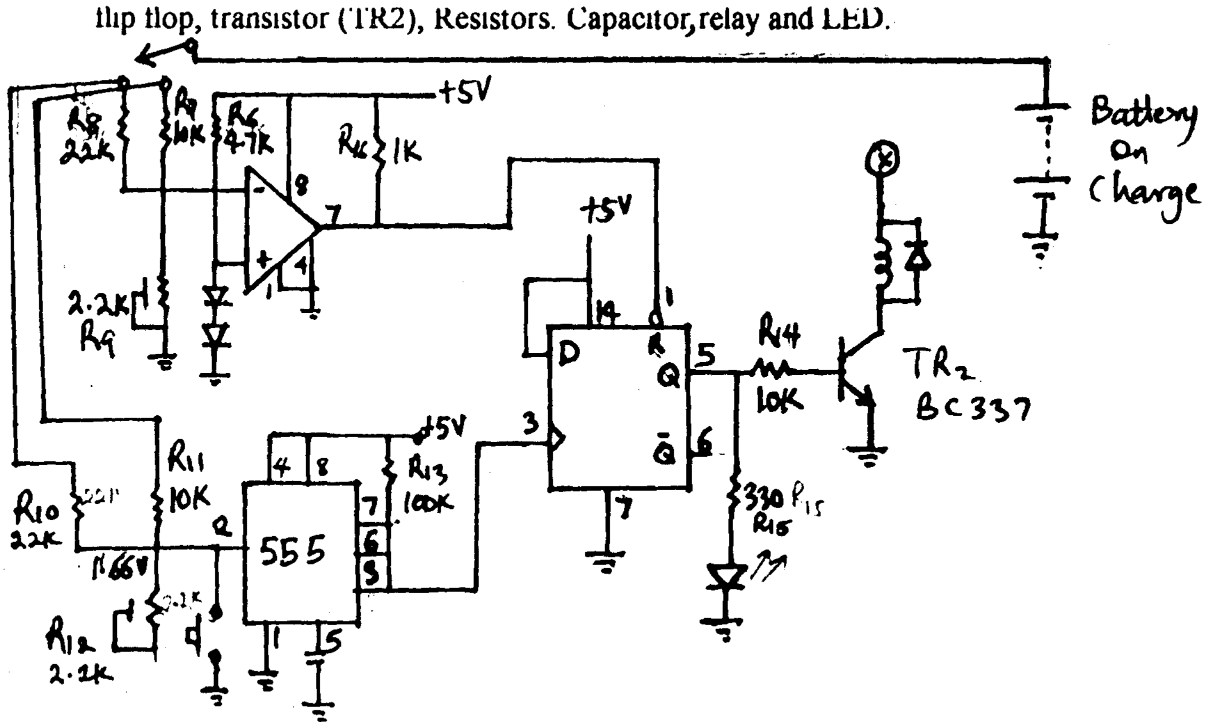


Fig 11 Control and switching circuit

2.31 COMPARATOR

A comparator is an integrated circuit. It is a voltage comparator. Basically corresponding to input conditions that are below or above certain voltage limits. The use of a comparator is as a level detector that provide a change in the output voltage when the input has exceed or fallen below a certain level present by the reference voltage. Here the reference voltage for this design is 1.2 V through the use of 2 diodes IN4148 which is equal to V1. The voltage to be compared with the reference voltage is applied at the inverting input as indicated below.

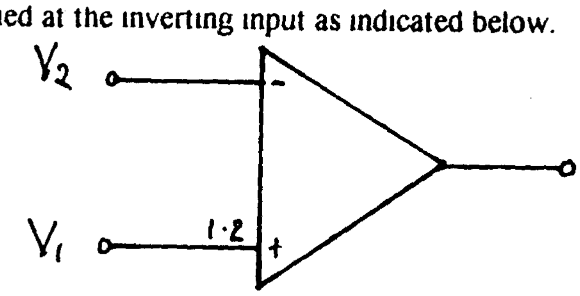


Fig 12 a A comparator IC

And the voltage at operation is such that when

V1 > V2 = 1

And

V1 < V2 = 0 (reset)

The comparator circuit compares the situation at the damper output with the Vref at 1.2V to obtain a value 1 or 0 signal which triggers the D – flip flop. The comparator used in this design is LM 311.

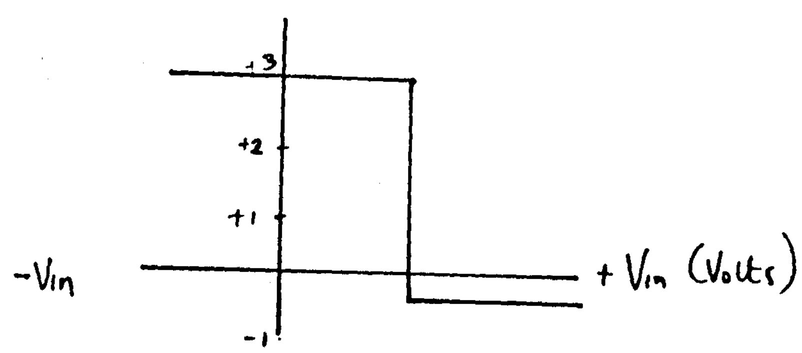


Fig 12b Level detector transfer Characteristics

2.32 THE 555 TIMER

the 555 Timer is a highly stable integrated circuit (IC) or generating accurate time delay or Oscillation, The 555 timer can be used with supply voltage in the rang of +5v to 18v and can drive load up to 200mA. For the 555 Timer to operated or be triggered, 1/3 Vcc has to be applied at the trigger input. The

555 Timer used in this design operated in the monstable mode.

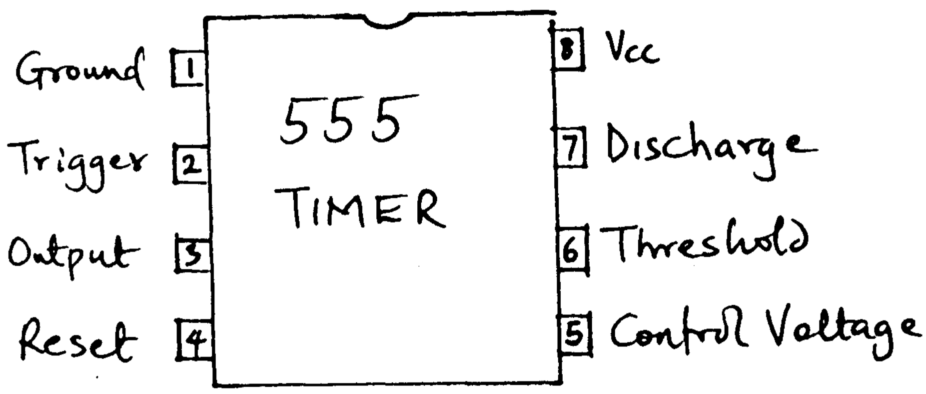


Fig 13 (a) 555 Timer showing Pin diagram

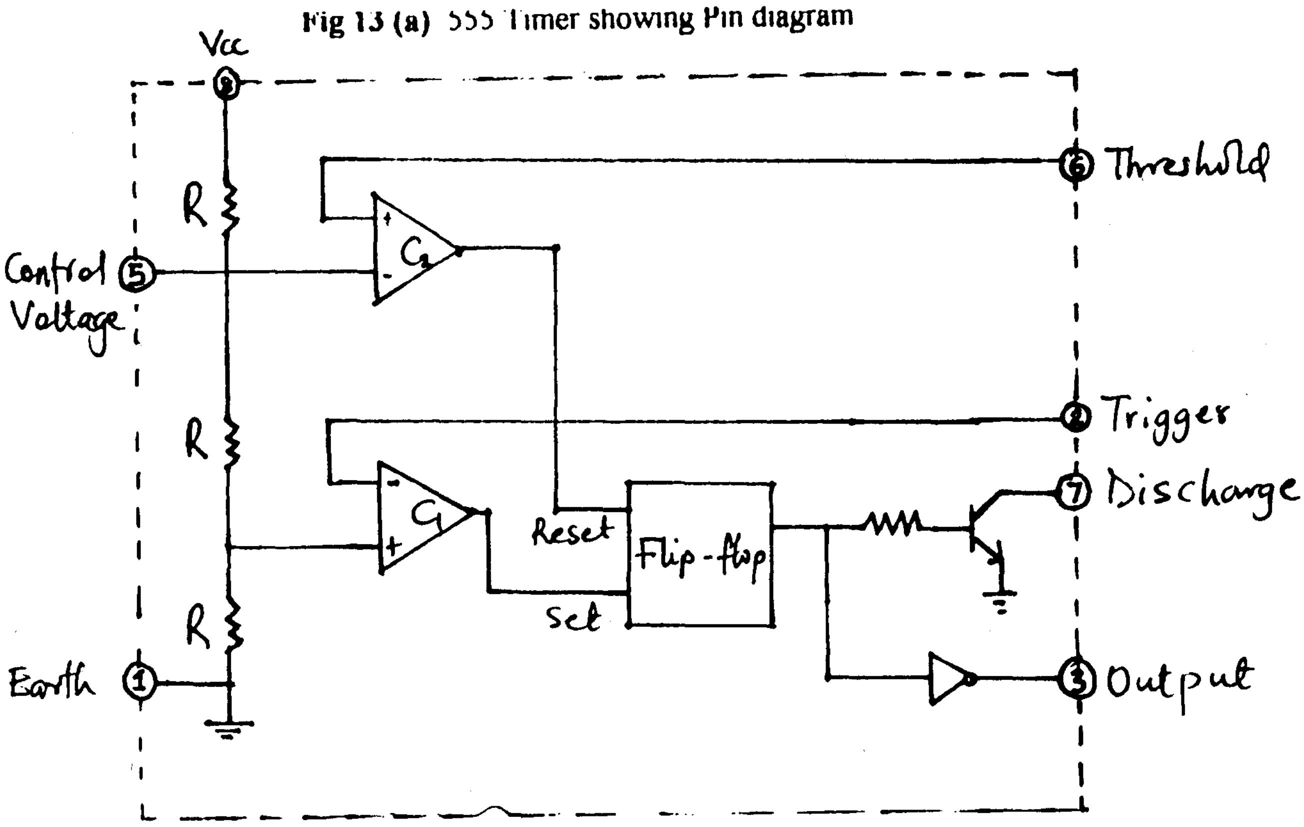


Fig 13 (b) circuit description of the 555 Timer

2.33 THE 555 TIMER AS A MONOSTABLE MULTIVIBRATOR

The basis of the circuit is a flip flop with set and reset inputs controlled by comparators. The quiescent condition in with the flip flop output high so that the timing capacitor Ct is shouted by the transistor T, the output than goes low because of the inversion in the output stage.

The trigger is normally held high by the internal circuit , and operates on a falling input edge: When the trigger input fall to Vcc/3, comparator 1 changes state and sets the flip – flip. The output goes low, sending the output terminal high and also turning of T, thus allowing timing capacitor C7 to begin charging through resistor Rt. Charging continues until the potentials difference across Ct rises to 2Vcc/3 when comparator 2 resets the flip – flop T is then turned back on, discharging Ct and awaiting the next trigger pulse. If however, the trigger input is still held below Vcc/3 at the end of the timing cycle the flip – flip will not reset and the output will remain high until the trigger is released. Pin 4 is an overriding reset which can be momentarily earthed to reset the device at any point in a timing cycle. The timed period can be calculated from the usual charging equation or an RC time constant

$V = V_o \{1 - \exp(-t/CR)\}$

Where Vo = Vcc and we require the value of t which gives

$V = 2/3\ V_{cc}$

$2/3 - 1 - \exp(-t/C_tR_t)$

2.34 7474 DUAL D – TYPE FLIP - FLOP

The "74" is a dual positive edge – triggered D – type flip – flop featuring individual data, clock, set and reset inputs and complementary Q and $\overline{Q}$ outputs. Set ($\overline{Sd}$) and reset ($\overline{Rd}$) are asynchronous active LOW inputs and operate independently of the clock input. Information on the data (D) input is transferred to the Q output on the LOW – HIGH transition of the clock pulse. The D inputs must be stable one set up time prior to the LOW – to – HIGH clock transition for predictable operation.

Although the clock input is level sensitive, the positive transition of the clock pulse between the 0.8 V and 2.0V level. Should be equal to or less than the clock to output delay time for reliable operation.

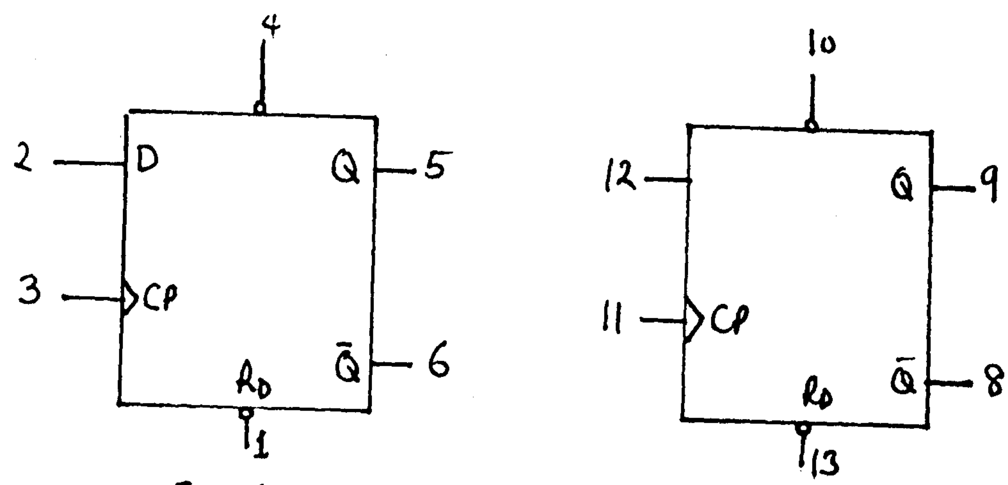


Fig 15 Showing 7474 Dual D - Type Flip-flop

The truth table

Mode of operation	inputs		output	
	D	CK	Q	$\overline{Q}$
Start charging, RESET	1	↑	1	0
Charge, RESET	0	↑	0	1

2.34 7474 DUAL D – TYPE FLIP - FLOP

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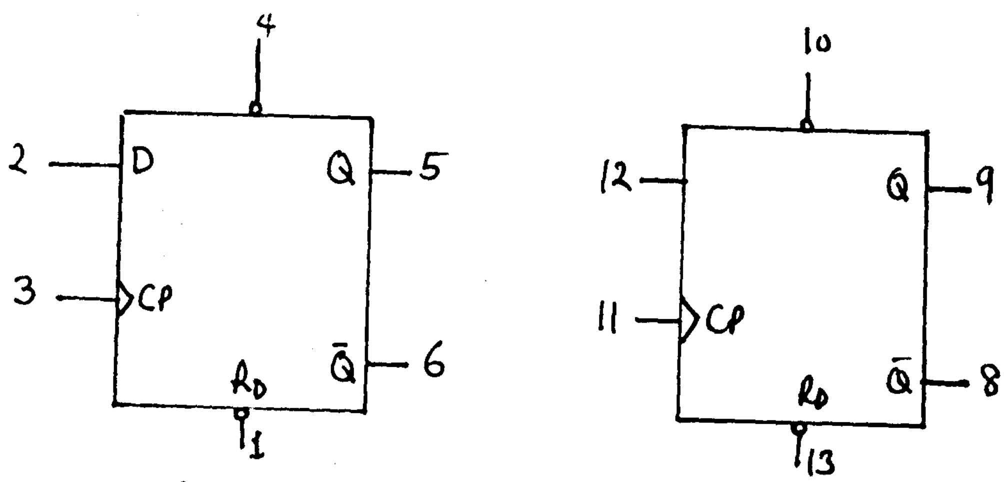


Fig 15 Showing 7474 Dual D-Type Flip-flop

The truth table

Mode of operation	inputs		output	
	D	CK	Q	$\overline{Q}$
Start charging, RESET	1	↑	1	0
Charge, RESET	0	↑	0	1

2.34 TRANSISTOR AS A SWITCH (BJT SWITCHING)

In many electronic systems, transistors are used as non – linear elements, that is as controlled switches. A bipolar Junction transistor (BJT) that is driven into cut off region passes essentially no current and appears as an open switch.

The transistor can be made to operate as a switch by controlling the base current (ie the transistor in either working in the cut off region (OFF state) or in the saturated region (ON state). At the cut of – region base – emitter and base – collector or junctions are inverse biased considering the circuit in Fig 16 (a) If the box current Ib is zero, than the collector current Ice will be a small leakage current and the voltage drop across the load Rl would be negligible, hence the voltage across collector – emitter junction is approximately the supply voltage that is

$Ve \approx Vs$ when the transistor is cut off

When saturation conditions is reached, both junctions are forward biased. The switch is controlled by the current applied to the base when the input signal is large and positive, the transistor saturates and the collector current is

$Icsat = (Vs - Vce, sat)/RL$

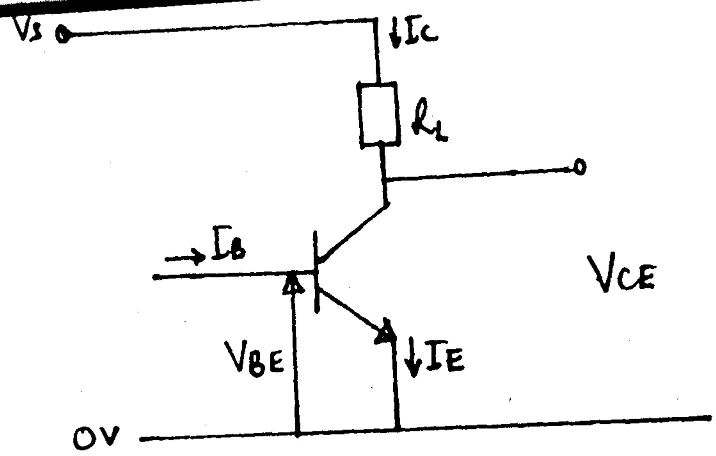


Fig 16 (a) common emitter switch

And the emitter current

$Ie = Ib + Ic, sat$

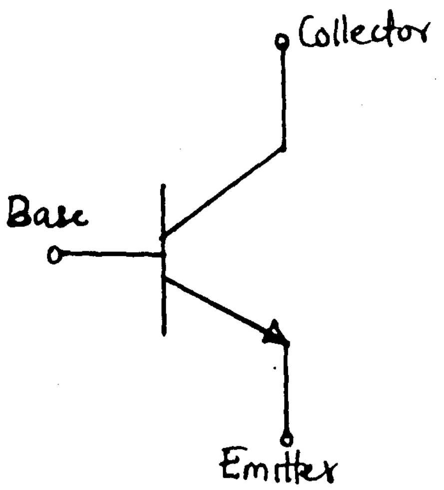
Base current at sat condition

$Ib > Ic, sat/hfe$

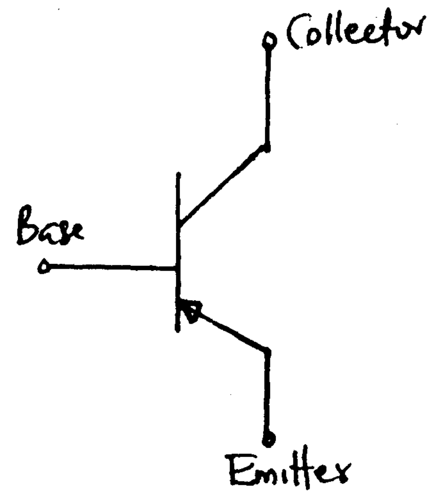
The voltage at this point

$Vce = Vce,sat$

The transistor used in this design is BC 337



NPN Transistor fig 16(b)



PNP Transistor fig 16 (c)

2.36 RELAY

A relay is an electromagnetic switching device that can be used as a remote control. The primary function of a relay is the transmission and control of electric current accomplished by mechanical contacting and actuating device. There are many kinds of relays in service.

The basic construction of a control relay consists of an electromagnet operating on a plunger

- When power is applied to the coil, it operates
- When power is removed, it returns to its previous position

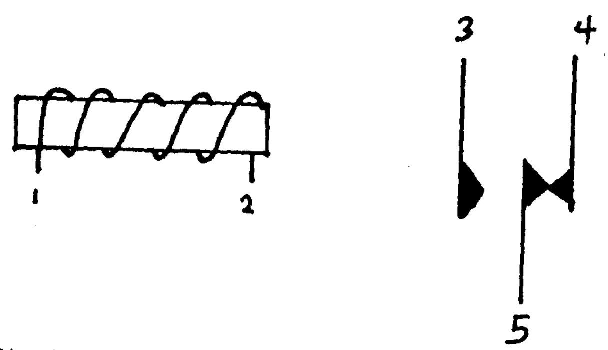


Fig 17

Conventional representation of a relay.

2.37 SYSTEM DESIGN CALCULATION

2.37.1 FOR COMPARATOR (LM311)

FOR 12V

$VR1 = R9/R9 + R7 \quad x \quad V$

Assuming R7 = 10K

$1.2V = R9/R9 + 10 \ x \ 12$

$0.1 = R9/R9 + 10$

$0.1R9 + 1K = R9$

$R9 = 1.1K$

FOR 24V

1.2 = 1.1K/1.1K + R8 X 24

0.05K + 0.05R8 = 1.1K

R8 = 1.045/0.05 = 21

Therefore preferred value R8 = 22K

2.37.2 FOR 555 TIMER

12V

VR2 = R12/R12 + R11 x V

1.66 = R12/R12 +10 x 10.5

0.158R12 + 1.580 = R12

1.876K = R12

FOR 24V

1.66 = 1.876/1.876 +R10 X 21

0.1482 + 0.079R10 = 1.876

R10 = 21.87

Therefore preferred value R10 = 22K

Also

T = 1.1RC

= 1.1R13C2

Aassume T = 1 sec

C2 = 1/1.1R13

= 1/1.1 x 100

C2 = 10UF preferred Value

2.37.3 BASE RESISTOR OR TR2

From data book

VBE = 0.7

IB = 0.43mA

RB = V – VBE/IB

= 5 – 0.7/0.43 x 10

= 10K

2.37.4 LIGHT EMTTING DIODE, LED

From data book

VLED = 1.7V

ILED = 25mA

R15 = 5 – 1.7/25 x 10

= 132

preferred Value 330 to protect the LED

2.38 PRINCIPLE OF OPERATION OF THE CHARGER

The circuit designed is a high performance charger with particular reference for load acid batteries. A charging device charges battery quickly and shuts off at full charge.

Before charging can commence the 555 Timer has to be triggered by at least 1/3Vcc i.e 1.66 volts. This can be arrived at by varying the variable resistor. Once the 555 Timer has been triggered by at least 1.66V. The 555Timer sends out a low to high signal at pin 3 (output Pin) which triggers or clocks the D flip- lip which results into a high signal. The relay is enabled by the BC337(TR2) acting as a switch. The relay is normally opened. The light emitting diode (RED) comes ON which indicates charging has began. A slide switch is provided to select the particular voltage level the battery is to be charged (12V or 24V). Voltage reference is fixed at 10.5V and 21V respectively. The comparator performs the central operation.

The fixed reference voltage is 1.2 (V1) and (V2) can be obtained by fixing a value for the variable resistor. Whenever V1 < V2 a reset signal is sent out at the output of the comparator which resets the D flip-flop indicating full charge at 12V or 24V, the light emitting diode (GREEN) comes on indicating full charge while the LED (RED) goes of preventing overcharging. The LED here is a dual indicator. A test Switch is provided to momentarily activates the charger when the battery is neither high or low.

CHAPTER THREE

3.0 CONSTRUCTION, TESTING AND RESULTS.

3.1 CONSTRUCTION

The circuit was constructed by soldering the components on a vero board as follows. The power supply which consists of a transformer, rectifiers, capacitor, voltage regulators.

Also, the charging section which consists of LM317T (2) and Transistor 2N3772 diode DXRP 608 was also soldered on the veroboard. The control and switching section which consists of a voltage comparator (LM311), 555 Timer, 7474 D flip - flop, Resistors, transistor BC 337 and relay was also soldered. Each section was soldered and tested and confirmed okay. Each section is tested before proceeding to the next stage.

Assembly components on a vero board presents special problems in terms of lead bending. Aligning insetting, crimping and protection the device before and during soldering. All these points need attention for the finished construction to be reliable.

Also an important precaution regarding the protection of the circuit components form excessive heat while soldering was taken into consideration. This heat is transferred form the soldering iron tip through the lead. As a result of this heat, manufacturers often provide assembly information together with the maximum allowance time that specifies temperatures that the device can tolerate without running the leads bands

The choice o resulting unwanted heat that can affect the components wires were also soldered to joints here connections or external circuits were needed. The dimension o construction and casing is shown which gives the front and side views. Galvanized iron sheet was used for the casing measuring (23 x 20 8)cm holes were made at the sides of the casing to allow for dissipation of heat and cooling of various components used.

3.2 TESTING AND RESULTS

After final construction of this project a 12Vbattery was put into test with a source voltage i.e battery whose voltage is less than 12vV is connected to the charger the light emitting diode (RED) will glow indicating charging and when the output of the terminal is 12V the battery is fully charged and the charging device isolates itself form the battery and light emitting diode (RED) goes off and LED (GREEN) comes on.

Also a 24V is connected to the test i.e battery whose voltage is less than 24V is connected to the charging device, the light emitting diode (RED) glows indicating charging and when the battery charges up to 24V the battery is fully charged and the charging device isolates itself from the battery and light emitting diode (RED) goes off and LED(GREEN) comes on indicating fully charged.

CASING

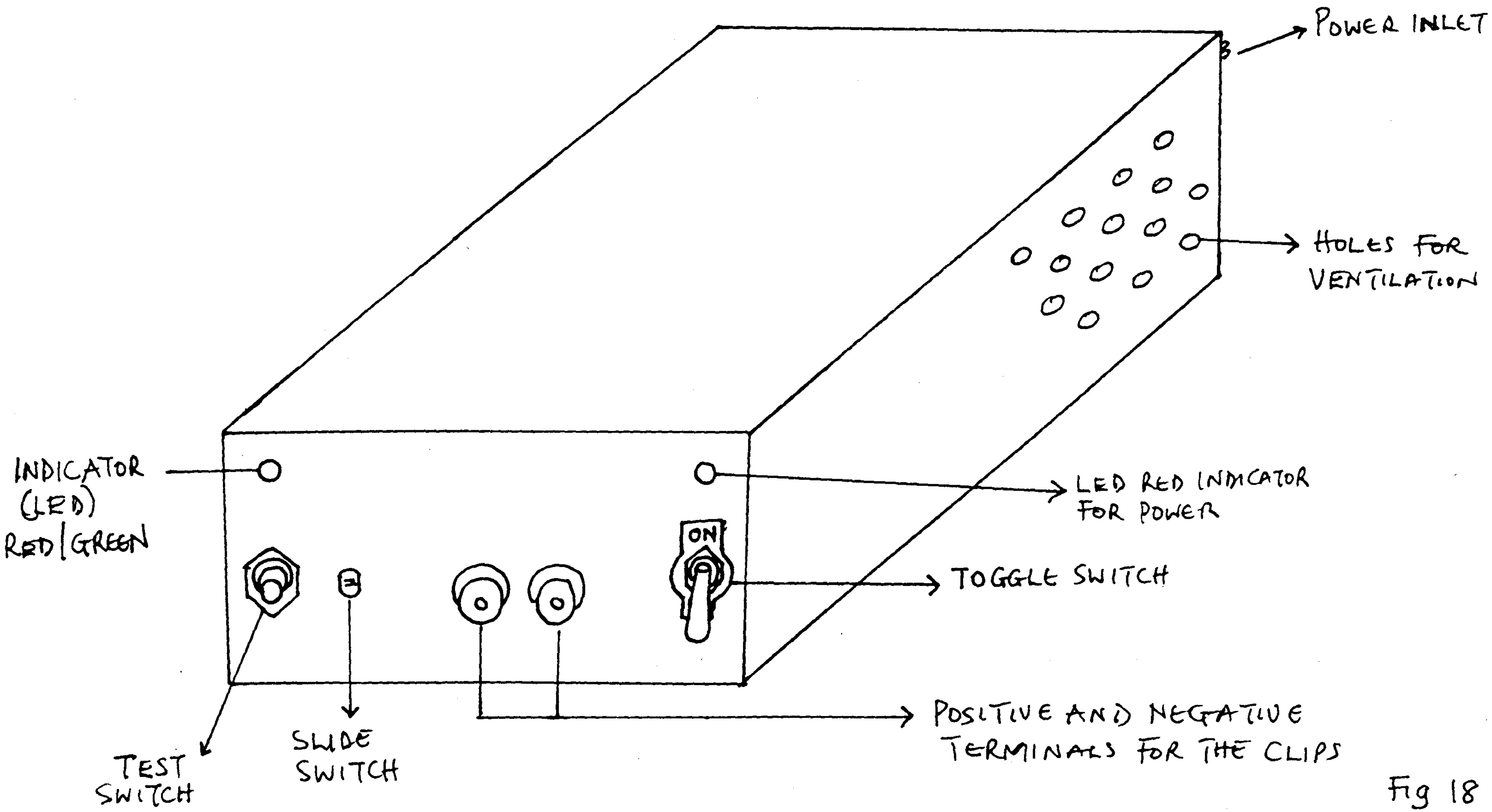


Fig 18

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Having designed the charging device and tested it, it can be seen that the section making up the battery charging device can be achieved form basic electronics principles and since run down secondary cells like the lead-acid since batteries could be recharged, greater economy is achieved as these batteries can no longer be discarded.

Also since it is a cheap source of power supply, if there is power failure from NEPA, offices and factories work can go as the batteries can be used to power the lighting bulbs. So the objectives of the project has been achieved and there is no fear of overcharging the battery.

4.1 RECOMMENDATION

I recommend that this project should be embarked upon on a large scale by the government research centers concerned or the universities. Also, students should be exposed to more result oriented practical works to ease problem when constructing

4.2 REFERNCES

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CIRCUIT DIAGRAM OF 12V AND 24V BATTERY CHARGING DEVICE