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CONSTRUCTION OF 12V BATTERY CHARGER

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Abstract :- The project presents the design and construction of a battery charger. A battery charger is an electrical device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The system consist of a step down transformer, an AC to DC converter and a DC voltage regulator. The circuits are designed using copper wire, rectifier diodes, electrolytic capacitors, resistors with other passive and active component of electronics. A battery charger is an essential element that powers any electronics products like UPS invertors system, photographic equipments , hand-held lamps (flashlight or torch), toys and automobile etc. these products will become useless if there is no charger to relief their battery when it runs down. In this project, a battery charger is designed not just to refill rechargeable batteries but to conserve the battery life because wrong handling and charging of battery can permanently damage the battery even if is brand new. With this project, people can recharge NI-Cad and lead acid batteries by themselves and the save money on battery purchases.

I. INTRODUCTION

Before discussing about the project let us understand some of the concept used in this project.

A.capacitor

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. A capacitor is a component which stores electric charge. It consists of two conducting surface separated by a layer of an insulating medium called dielectric. The conducting surface may be in the form of either circular or rectangular plate of spherical or cylindrical shape. The purpose of a capacitor is to store electrical energy by electrostatic stress in the dielectric. The capacitance of a capacitor is its charge-storing ability, the area of the plates (being large if the area is large) and the distance between the plates (being large if the distance is small) and the type of dielectric used in general. Capacitor is measured in farad (f), it is commonly expressed in microfarad, NF (=10^{-6}F), nano farad, nf (10^{-9}F), pico farad, PF(10^{-12}F).

Capacitor is of two types namely:-

1. Electrolytic capacitor (polarized)
2. Non-Electrolytic capacitor (No-polarized)

Fig. 1 Capacitor

B. **12v RELAY**

The **12v relay** is an **electromechanical switching device** which controls the AC devices through the DC power. Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

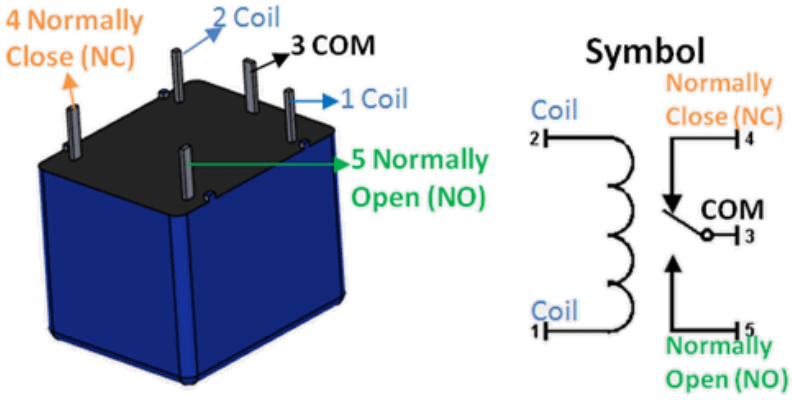


Fig.2 relay

C. LED bulbs

The colour of an LED is determined by its semiconductor material, not by the colouring of the 'package' (the plastic body). LEDs of all colours are available in uncoloured packages which may be diffused (milky) or clear (often described as 'water clear'). The coloured packages are also available as diffused (the standard type) or transparent.

Blue and white LEDs may be more expensive than the other colours.

Fig.3 LED bulbs

D. 10K PRESET

Cermet Preset 10K Ω (ohm) (Variable Resistance)

Cermet preset is a compact variable resistor and pcb mountable with 3 terminal pins. The voltage between the terminal varies as the preset is rotated.

The Variable resistors are used for variating voltage as per the need in a circuit. The outer two pins are connected to Vcc and 0V, and cetner pin outputs a variable volatge between 0v and Vcc as the rotary cermet is rotation.

Fig.4 10K preset

F. *Resistor*

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

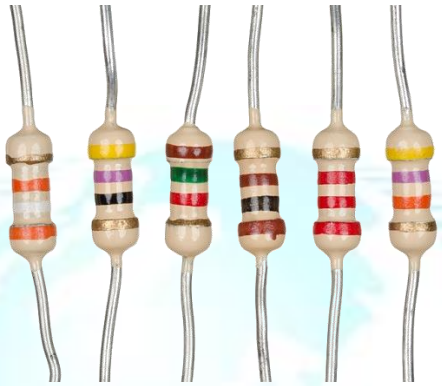


Fig. 5 Resistors

G. Diodes

A **diode** is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. A diode vacuum tube or **thermionic diode** is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate. A **semiconductor diode**, the most commonly used type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals.[4] Semiconductor diodes were the first semiconductor electronic devices. The discovery of asymmetric electrical conduction across the contact between a crystalline mineral and a metal was made by German physicist Ferdinand Braun in 1874. Today, most diodes are made of silicon, but other semiconducting materials such as gallium arsenide and germanium are also used.

Fig.6 diodes

H. *Transformer*

A transformer is a passive electrical device that transfers electrical energy from one electrical circuit to another, or multiple circuits. A varying current in any one coil of the transformer produces a varying magnetic flux in the transformer's

core, which induces a varying electromotive force across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits. Faraday's law of induction, discovered in 1831, describes the induced voltage effect in any coil due to a changing magnetic flux encircled by the coil. Transformers are most commonly used for increasing low AC voltages at high current (a step-up transformer) or decreasing high AC voltages at low current (a step-down transformer) in electric power applications, and for coupling the stages of signal processing circuits. Transformers can also be used for isolation, where the voltage in equals the voltage out, with separate coils not electrically bonded to one another. A transformer is an AC device that transfers electrical energy from one electrical circuit to another; it does so by principle of electromagnetic induction, when the transformer raise the voltage of its input to a voltage higher than that input to it, it is said to be a step-up transformer but when the transformer decreases the voltage is less than the input voltage. It is said to be a step-down transformer.

Fig .7 Transformer

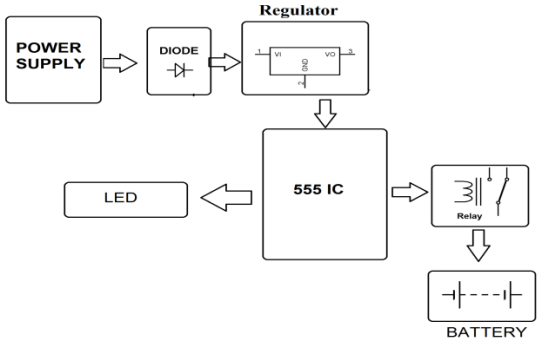
II. About the Project

A. Introduction to the Project

This battery charger is a devices used to store the electrical energy to the battery after the battery has been discharged itself. The battery charger is designed to use electricity as its source of switch, regulation transistor, diode, light emitting diode, construction wire. The charger is designed and constructed to deliver full current until the current drawn by the battery falls to 150MA. At this time a lower voltage is applied to finish off and keep the battery from overcharging by switching off itself when the battery is fully charged. A simple 12volts battery charger work by supplying a constant DC or pulsed DC power source to a battery being charged. The simple charger does not alter its output based on time. The circuit of a battery charger has the ability to convert voltages from one form to another (usually AC to DC voltages).

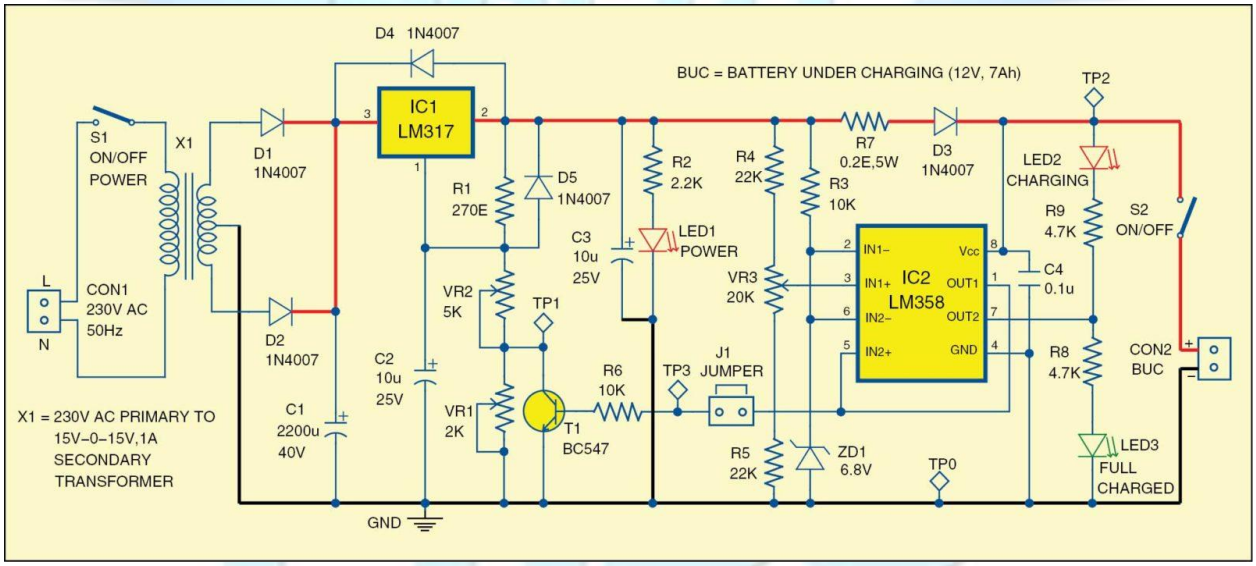
Therefore from my research I carried out due to this project. I have found that most of an electronic gadgets damage easily because of this charging problem which I listed below;

- Over charging
- Excess voltage
- Short circuit



B. Working Principle

If one coil is connected to a source of E.M.F a current flow through it. Since this winding links with an iron core so current flowing through this produce an alternating flux(o) in the core. This flux is alternating and links with the secondary winding is the same as that of the flux or that of the supply voltage. The induced E.M.P in the secondary winding enables it to deliver current to an external load connected across it. Thus the energy is transformed from primary winding to secondary by means of electromagnetic induction without change in frequency.



C. Limitations

The project is limited to 12V batteries. It is not advisable to use it on rechargeable batteries above 12V. Also there is no internal resistance connected in the battery charger to limit the short circuit current.

D. Application

A 12V battery charger is used in to charge many appliances like car battery, mobile, laptop and many other electrical appliances etc. Many of the electronic appliances work on 12VDC, and if its portable appliance it uses a 12V Battery to power up. In case the battery drains up fast we also need chargers for these rechargeable batteries. This project serves this need in a very simple and compact construct. With power source from the mains supply through an adapter this project can charge a battery with auto cut off feature. The output should be given to a 12VDC Battery. When a 12VDC Adaptor is connected to the system, the system powers up and scans if the output terminal has a voltage level less than 12VDC or not. If the Battery level is below 12VDC then the charging circuit is triggered ON. Charging remains ON till the Battery level reaches 12V and then the charging circuit is turned OFF automatically. The voltage sensing IC senses the voltage level to trigger the charging events. 12VDC voltage level has to be configured into the IC so that it considers this voltage level as the reference level. Once the reference is set the monitoring by the IC triggers a relay to charge the Battery if it is found to be below the reference level. Similarly, the relay is turned OFF automatically once the charge level reaches or passes by the reference level or 12VDC.

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