Construction Of Solar Thermionic Converter

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Abstract- *Thermionic converters can convert heat energy into electrical energy through thermiocemisssion , these deviceare required less maintanence and reliable Since they do not have any mechanical moving parts. In this properties of 2N305ed5 silicon po0wer transistor has been investigated and preliminary result suggest that this transistor can work as solar thermionic power converter, and the things we are used that commonly available and simple electronic component was used.*

Scope –

- *This project is limited to construction of a solar thermionic power converter with an output current, voltage and power of 3V, 12V and 36W respectively to power 26W compact florescent light bulb by making use of 2N3055 power transistor .*
- *The construction of solar panel which utilizes the same principle of thermionic vaccm tube according to the known principle of thermionic energy conversion*

I. INTRODUCTION

Thermionic energy conversion is the direct production of electric power from heat by thermionic electron emission. From a thermodynamic viewpoint, it is the use of electron vapor as the working fluid in a power-producing cycle. A thermionic converter consists of a hot emitter electrode from which electrons are vaporized by thermionic emission and a colder collector electrode into which they are condensed after conduction through the inter-electrode plasma .The resulting current, typically several amperes per square centimeter of emitter surface, delivers electrical power to a load at a typical potential difference of 0.5–1 volt and thermal efficiency of 5–20%, depending on the emitter temperature (1500–2000 K) and mode of operation

DEVELOPING THERMIONIC CONVERTER:

Thermionic converters can convert heat energy into electrical energy through thermiocemisssion , these deviceare required less maintenance and reliable Since they do not have any mechanical moving parts. In this properties of 2N305ed5 silicon po0wer transistor has been investigated and preliminary result suggest that this transistor can work as solar thermionic power converter, and the things we are used that commonly available and simple electronic component was used.

II. LITRATURESURVEY

GENERAL OVERVIEW OF THERMIONIC POWER GENERATION (Kevin Gemayel)-2017, In the present world of latest researches, a very hot domain of research is power generation. The conventional ways of acquiring power are now limited. Natural resources i.e. fossil fuels are not reliable for the future use. Also, the pollution aspect of this resource worsens its use. So, in this report, thermionic power generation has been studied descriptively. The devices used for thermionic power generation are thermionic converters which have been explained thoroughly. Brief calculations have also made for the thermionic energy converter design. The aircraft industry has a key use for this technique and the relevant approach has also discussed for utilizing the external high temperature of aircraft for thermionic energy production.

Modernizing a Technology From the Vacuum Tube Era To Generate Cheap Power Julie chao- 2018,said ,When scientists Daniel Riley and Jared Schwede left Stanford University last year to join Cyclotron Road, a Lawrence Berkeley National Laboratory (Berkeley Lab) program for entrepreneurial researchers, their vision was to take thermionics, an all-but-forgotten technology, and develop it into a clean, compact, and efficient source of power. Little did they know that soon after arriving, a collaboration with a Berkeley Lab scientist would allow their research to take a big shortcut, providing them with unprecedented insight into the inner workings of thermionic devices

THE THERMIONIC ENERGY CONVERTER W. B.nottinham-2008, said,The introduction of cesium into a thermionic device serves to improve its potential efficiency in three ways. It can improve both the emission capability of the emitter and the conduction properties of the space between the emitter and the collector, and it can lower the work-function of the collector. All of these features are advantageous. In some respects, the establishing of a plasma in the intervening space might be considered a most important factor, in that it permits

the designer to build in a converter with realizable spacing. One of the principal points of this report is to show that under suitable conditions, a positive ion space-charge sheath forms in the immediate neighborhood of the emitter and, as a result of this space-charge situation, electrons are accelerated from the emitter into the intervening space. Here, because the concentrations of ions and electrons are practically equal, plasma oscillations develop and the energy distribution of the electrons changes from a monoenergetic one associated with an energy of the order of 0. 5 volt, or more, to a quasi-Maxwell-Boltzmanndistributioncharacterized by a temperature of 5000' K, or more. Such an electron distribution is sufficiently rich in high-energy electrons to ionize the gas and maintain it in a state of practically 100 per cent ionization. Thus a highly conducting plasma is formed to serve the purpose of permitting a high-density electron current to flow from the emitter to the collector. Cesium also serves to reduce the work-function of the collector, and it is anticipated that high efficiency will be obtained as these features are incorporated in the design and operation of the plasma diode as an energy converter

III. DETAILED DESIGNATION AND COMPOSITION OF THERIMIONIC CONVERTER

MATERIAS REQUIRED :

1.2N3055 Transistor
2.soldering iron
3. insulation
4. multi meter

2N3055 Transistor

The 2N3055 is a NPN transistor intended for general purpose applications. It was introduced in the early 1960s byRCusing a hometaxial power transistor process, transitioned to an epitaxial base in the mid-1970s. Its numbering follows the JEDEC standard. It is a **transistor** type of enduring popularity.

SOLDERING IRON

A soldering iron is a hand tool used in soldering. It supplies heat to melt solder so that it can flow into the joint between two workpieces. A soldering iron is composed of a heated metal tip and an insulated handle. Heating is often achieved electrically, by passing an electric current (supplied through an electrical cord or battery cables) through a resistive heating element.

INSULATION

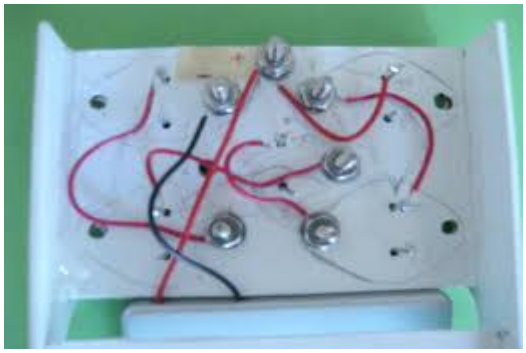
An insulator is a material that does not conduct electrical current. Insulating materials include paper, plastic, rubber, glass and air. Vacuum is also an insulator, but is not actually a material. Most electrical conductors are covered by insulation.

MULTIMETER

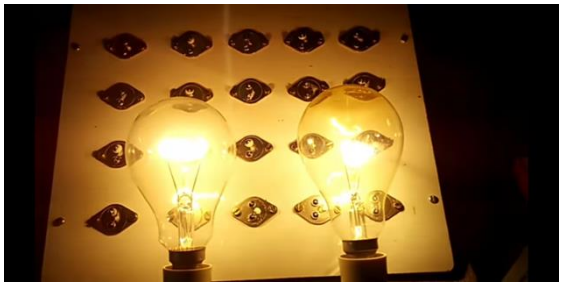
A multimeter or a multi tester, also known as a VOM (volt-ohm-milli ammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance. Analog multimeters use a microammeter with a moving pointer to display readings.

PREPARATION OF THEMIONIC POWER CONVERTER

CUTECTION OF 2N3055 TRANSISTOR



SOLDERING PROCESS OF TRANSISTOR



SETUP OF THE SYSTEM

IV. TEST TO BE PERFORMED

The Constructed system was first tested with the aid of digital multimeter by focusing rechargeble led lamp on it and the output voltage was 0.2V . It was later exposed to direct sunlight since the design system it mean to be operated through a thermal source in which it gave on output voltage of 0.75.

V. RESULT

The voltage and current outputs were monitored for a two days from 9am to 5pm a an hourly interval. The solar intensity of generated output was also measured with the aid of a light meter measured in Lux .the power output in each use was also calculate and the tabulated as follows.

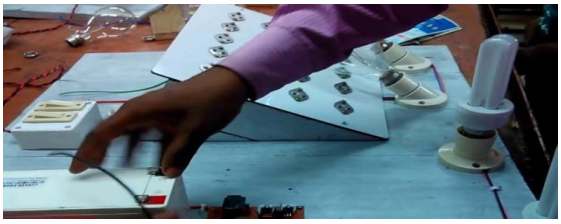
DAY 1-5 RESULT AVERAGE

Time(hr)	Current (mA)	Power(mW)	Voltage(V)	Solar intensity(Lux)
9.00	0.87	1.26	1.66	936
10.00	1.45	3.47	2.88	1700
11.00	4.06	14.0	4.01	2560
12.00	3.37	15.0	4.0	2830
13.00	3.99	15.40	3.98	2820
14.00	4.13	21.66	5.16	3170
15.00	3.22	18.55	4.66	2960
16.00	3.46	10.52	3.55	2130
17.00	0.72	01.18	1.62	1080

VI. CONCULSSION

In this report, power generation through thermionic emission has been discussed in detail. Various aspects of thermionic converters have been seen. Thermionic power generation is indeed a fantastic rising method of acquiring power. Currently, it has somehow higher cost than methods of power production in use. But maintaining a higher efficiency will lead to make it economically feasible and it will become a high ranked niche of research in future. Thermionic power generation . Current needs for fuel-efficient, low emission, power sources for applications in sensor and subsystems in all-electric aircraft and onboard spacecraft has brought forth a renewed interest in this technology. When used as power harvesting devices, solid state-based power harvesters have the added benefits of robustness for service in extreme environments such as gas turbine engines

FINAL SETUP



VII. APPLICATIONS AND ADVANTAGES

APPLICATION :

- Increasing the efficiency of power plant
- Alternative solution for pv solar panel

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